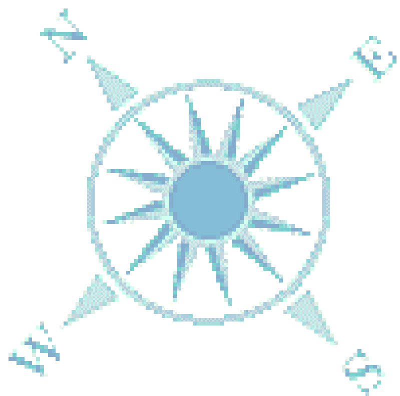
Computerized Optimization Model for Predicting and Analyzing Support Structures



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INTRODUCTION

1.1 About This Manual

This manual will provide a user with the information required to operate the Computerized Optimization Model for Predicting and Analyzing Support Structures (COMPASS). It is divided into six main sections: introduction, Installation, Running COMPASS, Outputs, Modeling, and Trouble Shooting. Each specific section is described below.

The Introduction section establishes the foundation for COMPASS. The subsection titled, "Level of Repair Analysis (LORA)," defines a LORA, explains the LORA process, and identifies the time when LORA should be conducted, discusses the role of the government and contractors when performing the LORA, and identifies regulations that refer to the LORA. The last subsection is titled, "Model Overview," and it highlights the features that make up COMPASS.

Section 2 explains how to install and run the COMPASS program on your personal computer (PC).

Section 3 discusses the procedures and screens related to the operation of the COMPASS program. These include: opening, saving, printing, importing and exporting files, and viewing the output reports. This section also explains how to create, modify, and execute COMPASS input data files, and how to edit policy files.

Section 4 provides an explanation of the COMPASS output products. The section also provides information on how to interpret and utilize the results to establish maintenance concepts. It discusses performing sensitivity analysis and identifies what effect altering certain logistics parameters will have on the overall system.

Section 5 provides an explanation of modeling in COMPASS. Details are given on how to setup a basic system and how to handle special cases. A discussion of Non-Economic factors and how they can influence modeling is included.

Section 6 provides information on obtaining technical support for COMPASS and some basic troubleshooting guidelines.

This manual also includes several appendices. Appendix A is an index of all the input data elements. Appendix B is an example of a front-end analysis report. Appendix C lists examples of the printed version of the output reports generated by the optimizer or evaluator. Appendix D lists the default data values. Appendix E lists relevant documents pertaining to LORA and provides a listing of other LOGSA produced software that can be used in conjunction to COMPASS.

1.2 LORA

LORA is an analytical methodology used to establish the maintenance level at which an item will be replaced, repaired, or discarded. These decisions are based upon economic, non-economic considerations and operational readiness requirements. In simpler terms, LORA determines the most cost effective maintenance concept of a system.

LORAs should be conducted on every system acquisition program, as defined by AR 750-1 and AR 700-127. These regulations state that analytical techniques and models will be used to develop and evaluate alternative support concepts. LORA is an integral part of the systems engineering program and is applicable to all phases of the life cycle. The results of the LORA are used for the following: to influence design (i.e., discard versus repair); determine the allocation of spares (initial and consumption) and the associated cost of procuring those spares; assist in assignment of the Maintenance and Recoverability portions of the SMR codes; determine the allocation and cost of manpower and support equipment at each maintenance level; provide development and assignment of maintenance tasks for establishment of the Maintenance Allocation Chart (MAC).

Either the contractor or government may conduct LORAs. It is at the discretion of the government agency to determine what role the contractor will play in the LORA process. This is the preferred methodology for conducting LORA within the Army. In some instances, the government may allow the contractor to perform the entire LORA analysis. Results of the analysis will be documented and supplied to the government for review and approval in the form of a LORA report. In other instances, the government agency may find it more beneficial to require the contractor to only supply the data necessary to perform the LORA. The LORA effort will then be conducted in-house using data supplied by the contractor. The COMPASS program will identify the most cost-effective maintenance concept.

The recommended process for conducting a LORA begins with defining the problem. Consideration of policy, design alternatives, user requirements, cost drivers, acquisition strategy and program schedule requirements all play a part in formulating the scope of the effort. Data availability and robustness must also be included in formulating the analytical scope and determining sensitivities that should be analyzed. Results should be updated to support program decision levels (i.e., design reviews, milestone reviews, etc.) and when updated information becomes available.

Another term associated with LORA is the LORA Process. The LORA Process consists of several steps, which are implemented in accordance with program requirements. Figure 1-1 provides a general portrayal of the process.

Once the system has been defined and data collected, a series of non-economic, economic, and sensitivity evaluations are conducted. Non-economic considerations are determined by evaluating/interpreting systems engineering related efforts or studies such as: safety assessments, transportability studies, vulnerability assessments, human factors engineering studies, etc. Results of these analyses are used in determining constraints that are incorporated into the LORA model's input file. Once these constraints have been identified (along with operational readiness requirements goal), economic factors that include both cost and performance factors can be evaluated to determine the most cost-effective maintenance concept for each item. Economic evaluations consider cost factors (e.g., spare parts, transportation, inventories, labor, and training) and performance factors (e.g., Mean Time To Repair (MTTR), Operational Availability (A_o), and Mean Time Between Failure (MTBF)). Non-economic evaluations consider pre-emptive factors (e.g., safety, mobility, vulnerability, policy, and manpower) that restrict or constrain the level where repair/discard can be performed. Sensitivity analysis is performed to determine what the effect of altering logistics parameters will have on the optimal maintenance plan. Most sensitivity studies are based on inputs that may not be well established or are apt to change. Other studies focus on user defined maintenance plans as compared to the optimal policy.

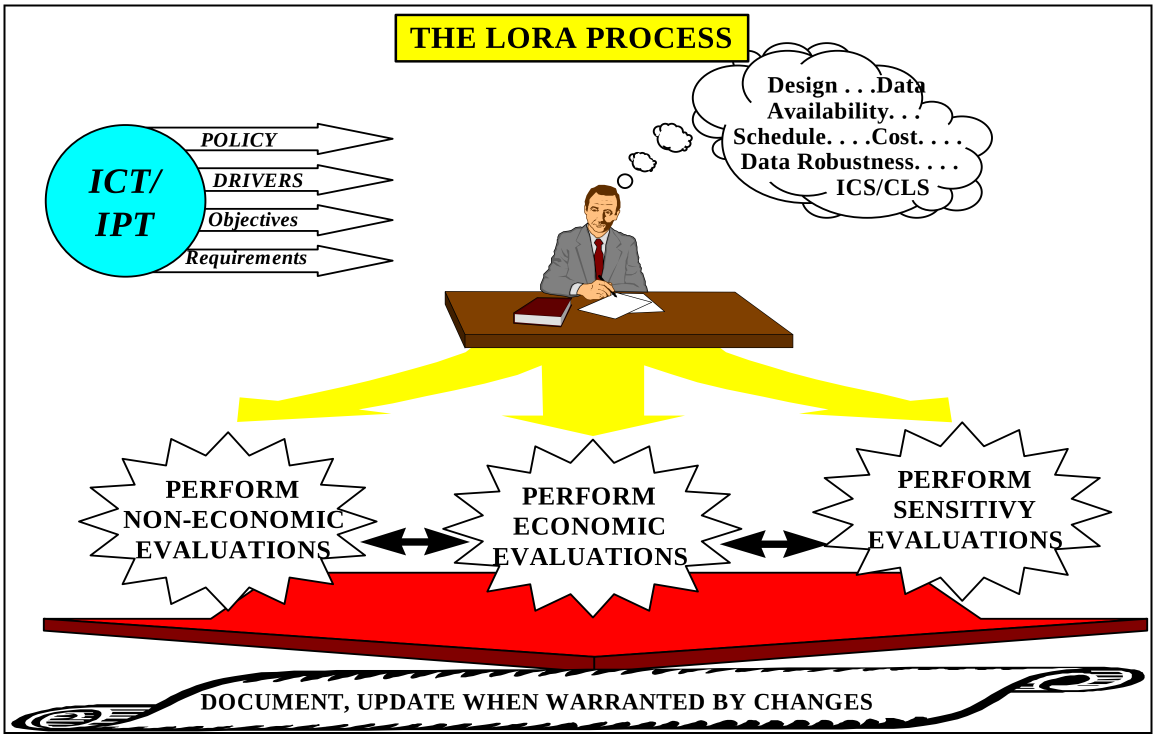


Figure 1-1

After completing the analysis, all results should be documented in a report. This report should contain such elements as: identification of all assumptions made in the analysis; identification of the model used in the analysis; sources for all data that was collected; the level of repair or discard recommendation for each item undergoing the LORA; a discussion of the sensitivity analysis performed along with results of the sensitivity analysis; and a listing of the outputs generated by execution of the LORA model.

1.3 COMPASS Overview

The COMPASS program is a PC based model designed to assist the analyst in conducting a Level of Repair Analysis (LORA) study. COMPASS is the Army's approved system-level LORA model. The COMPASS program will identify the most cost-effective maintenance concept.

The COMPASS program considers up to four levels of maintenance and supply support. It will identify the most economical maintenance level to repair or discard the end item and all line and shop replaceable units that make up the end item. It also has the ability to evaluate the life cycle costs associated with a user-defined maintenance concept, to assist the analyst in determining the effects of implementing different maintenance concepts.

The maintenance concept output by COMPASS is based on considering all maintenance and supply related factors concurrently. The program has two execution options. In the first, called optimization, the user allows COMPASS to determine the least cost maintenance concept based on the input data. The optimization output report will provide the recommended maintenance level where each item should be removed and replaced. In addition, the report shows whether the item should be repaired or discarded, and where the repair task should be accomplished.

The second option, evaluator, allows the user (analyst) to input his own maintenance concept and have COMPASS evaluate the overall LCLC for the system being modeled. This option is used to perform sensitivity analysis, or determine impacts when non-economic constraints are imposed on the system.

The least cost maintenance alternative for each item is based on formulation of a mixed-integer, linear program. The objective function is to minimize the cost based on the constraints imposed (which are defined by the analyst). During an optimization run of COMPASS, a mixed-integer program is used to optimize the function. The COMPASS model uses a program called XPRESS-MP, which is PC based and available commercially through a license acquisition. The XPRESS-MP program is embedded into the COMPASS software and is transparent to the user.

COMPASS uses the same supply algorithms that are contained in the SESAME model. SESAME calculates the provisioning requirements based on a target A_o; therefore, COMPASS will provide stockage at a quantity sufficient to achieve this A_o value. These stockage computations meet the Army sparing to availability requirements.

The COMPASS program can execute the following three types of modes: normal; screening and multiple repair. The normal run mode has only one method of repair for each item and does not consider screening. Screening evaluates the cost effectiveness of identifying items that have been falsely removed before they are sent on for repair. Screening should be considered if certain items are experiencing high false removal rates. When an item is considered for screening, COMPASS calculates the cost effectiveness of screening (performing a go/no-go test) based on data input by the analyst. When the COMPASS program is run in the multiple repair run mode it will not only determine the most economical level of repair, it will also determine the most economical method of repair for an item. The COMPASS program can consider up to three repair alternatives in a single run. For example, an item can be repaired three ways using common support equipment, special support equipment, or automatic support equipment. This option allows the user an evaluation tool for analyzing different types of support equipment.

Within COMPASS, the analyst identifies the manpower and support equipment requirements for each reparable item being modeled. Based upon these inputs, COMPASS will calculate, when executing the optimizer, the optimal locations to place all manpower and support equipment. It will also determine the overall requirements (i.e., quantity and cost) of each repairman and piece of support equipment at each maintenance location. When executing the evaluator, COMPASS will determine the overall requirements for repairmen and support equipment based on the maintenance concept specified by the analyst.

When the user inputs the data pertaining to the Support Equipment/Repairmen, COMPASS requires the analyst to identify the lowest echelon where the support equipment or repairman is authorized and the lowest echelon where support equipment/repairmen are common. The authorization input is a non-economic constraint imposed on the system, which restricts the level where the piece of support equipment or repairman can be placed. Therefore, restricting where items can be removed/replaced and repaired, if this piece of support equipment or repairman is required for the repair task. Support equipment and repairmen are considered common at a maintenance echelon if they are used to maintain more than one system (i.e., different end items). In this case, their resources (time available) will be shared with other systems and COMPASS will not charge the entire cost of the support equipment or repairman against the end item being modeled. The output will be a fractional amount based on the amount of time the support equipment or repairman is required to maintain the end item under analysis. The analyst may also identify a piece of support equipment or repairman as being not common (i.e., peculiar) at various maintenance echelons. In this case, the item is not currently located at that maintenance echelon. If this piece of support equipment or repairman is to be located at that echelon, they will be dedicated to the system. Therefore, no matter what amount of time they are used in the system's repair tasks, COMPASS will charge the entire cost against the system.

The COMPASS software has many additional features, which include: economics of contractor repair of items versus organic repair; consideration of redundancy; and the consideration and use of end item floats. These features are described in the section 1.4.2, Special Features of COMPASS.

1.3.1 COMPASS Input Requirements

The input data required to execute COMPASS is grouped into the following 12 categories: system information; supply; common labor; transportation; support equipment; repairmen; end item; Line Replaceable Unit (LRU); Shop Replaceable Unit (SRU); non-reparable LRU (NLRU); non-reparable SRU (NSRU); and special. A brief description of each category is contained in the following paragraphs. Detailed discussion on the input data, including how to enter and modify the data, if provided in Section 4.

The system information data group contains control parameters that control how other data screens are displayed. This data set also contains questions pertaining to how the item is to be modeled (i.e., end item floats, redundancy, and contractor repair). The supply group is used for common, supply-related input data (i.e., cataloging cost, bin cost, documentation cost, etc.). Common labor provides information about common repairmen used to perform maintenance tasks when no special repairmen are required. Data related to transportation of items (i.e., cost per pound for shipping and order and ship times) is entered on the transportation data screen.

The support equipment screen is used to enter data pertaining to any common or peculiar piece of support equipment required for diagnostics/repair of the items being analyzed. This data includes: unit price; development cost (if applicable); available hours per year; and annual maintenance cost. The next category, repairmen, is similar to data entered under the support equipment screen, except it pertains to special repairmen required for performing maintenance tasks. Repairmen data includes: salary; training cost; loading factor; and productive man-hours per year. Both support equipment/repairmen data include questions about where the support equipment/repairmen can be placed and whether the support equipment/repairmen are common or peculiar.

The next five groups of data (end item, LRU, NLRU, SRU, NSRU pertain to the items being modeled. The model can consider up to four levels of indenture (end item, LRU, SRU, and piece parts). An item's indenture level is classified by the following definitions: (a) If the item is removed and replaced to repair the end item, the item would be an LRU (i.e., LRU or NLRU); (b) An item removed and replaced to repair an LRU is classified as an SRU (i.e., SRU or NSRU); (c) Piece parts are items removed and replaced to repair an SRU and are nonreparable; and (d) a NLRU or NSRU is an item which is automatically discarded upon failure. Data for the end item, LRUs, and SRUs include: MTBF; MTTR; false removal rate; washout rate; weight; and what support equipment or repairmen are required to repair each item.

The last data category, special, contains data used to perform special evaluations. This data category includes: discount rate; war factor multiplier; and wholesale fill rate, for example. Additional data screens will be displayed based on how you are modeling your system. For example, when COMPASS is run in the screening run mode an additional screen will be displayed that requests screening data on the item being considered for screening. Other data will be required if you consider contractor repair of an item, end item floats, or redundancy.

1.3.2 COMPASS Output Products

The model has many output reports available for use by the analyst. The first report is called the Front-End Analysis (FEA) report. The FEA report is a tabular listing of all input data and is used for reviewing the accuracy of the data input. It also provides the calculated MTBF of the end item based on the MTBF's input at the SRU level. The main output report is produced anytime the optimizer or evaluator is executed. The main output report contains the following information: maintenance concept by application; allocation and cost of support equipment and repairmen; replacement task distribution and maintenance task distribution for each item; amount and cost of initial spares; the cost of consumption spares; and the overall Life Cycle Logistics

Cost (LCLC) of the system based on the number of years analyzed.

In the output report, COMPASS not only identifies the number of initial spares for each item, it also identifies the maintenance echelon where the spares should be placed. The model will also determine cost of replenishment spares for each item over the life of the system.

The replacement task distribution and maintenance task distribution output by COMPASS should be used as an input in provisioning. The life cycle maintenance and support costs calculated by COMPASS, which are dependent upon the repair level decisions, include the following: transportation; cataloging; bin; documentation; requisition; common labor; and inventory holding. For each item under analysis, COMPASS will compute the cost associated with each of these cost elements. The COMPASS program also provides the total cost for each of the cost elements calculated and the A_o achieved.

1.3.3 Special Features Of COMPASS

COMPASS includes an online help facility. The online help allows the users to access information on any command/input data element contained within the model. Other aspects of COMPASS that increase its user-friendliness include: default files, which contain common input data values; tailoring of input files to any specific application; and an online OSAMM conversion routine to convert a OSAMM input file to a COMPASS input file. Others features of the COMPASS program include: consideration of contractor repairs; end item floats; redundancy; and cost effectiveness of developing a TPS. A brief description of these features is provided in the following paragraphs.

Contractor repair enables the user to consider contractor repair for any item. Therefore, the contractor repair data will only be required for the items selected. This feature decreases data input requirements, which is a major task when conducting any LORA study. When COMPASS considers contractor repair of an item, it first determines what is the most economical organic level of repair. Then COMPASS compares the cost of repairing the item using organic support to the total cost the contractor would charge to repair the item and selects the least cost alternative of the two.

Consideration of end item floats is another special feature of COMPASS. End item floats are "spare end items" that are issued to the appropriate unit when the original equipment fails. The float is issued only for the time it takes the failed equipment to be repaired. The analyst has the option to issue floats only when specific LRUs have caused the failure of the end item. Usually floats are issued for LRUs that have a long and complex repair. When the remaining LRUs fail, a float would not be issued because repair can be accomplished quickly, and therefore, against policy established in AR 750-1. When COMPASS is programmed to consider floats, stockage of the end item will be calculated and output in the system report, which is also true when modeling the end item as an assembly (i.e., as a LRU).

The COMPASS program can be used in consideration of operating redundancy within an end item. Operating redundancy occurs when there are two or more of the exact same LRUs within the end item, all operating simultaneously. However, if one of these LRUs fails, it may not cause failure of the end item because only a specific number of these LRUs have to be operational for the end item to be operational. The purpose of redundancy is to increase the A_o of the system.

Economics of a TPS is another feature of COMPASS. A TPS is the program that tailors the automatic test equipment to the Unit Under Test (UUT), through an interconnect device, in order to identify and isolate UUT faults. Within COMPASS, the analyst will identify the cost associated with developing and maintaining the TPS. Once COMPASS is executed, it will determine if it is more economical to repair the item using the TPS and automatic test equipment or discard the item. If the item is discarded, the TPS will not have to be developed and maintained, which could result in a net savings.

INSTALLATION

2.1 Computer Requirements

COMPASS is designed to run on a PC. The minimum requirements to execute all aspects of COMPASS follow:

Pentium II 266 Mhz or better processor

64 MB RAM but more is better in this department.

10 MB of hard disk space.

Windows 95/98/NT 4.0/2000.

COMPASS 3.0 is a hybrid Windows/DOS program. While the installation, data entry, file manipulation, printing, and maintenance policy optimization are all handled in Windows, the number crunching routines are still mostly DOS based. Since the DOS BASED portions are present, users will have to pay homage to them by making sure not to use filenames that don't follow the old 8.3 standard and it is recommended that directory path segments be kept to 8 characters or less. Examples of these are: **input2.mdb and c:\comp30\data**. The DOS based portions will be eliminated in future revisions.

2.2. Installing Compass

Installation procedures for installing COMPASS on your computer follow:

1. If the installation program doesn't automatically startup when you insert the CD into the CD drive, then click on the start button and select "Run" from the menu. At this menu click the browse button and select the CDROM drive. This drive can also be selected from Windows Explorer.

2. Select Setup.Exe from the file menu and click "Open". This will take you to the previous dialog box. Click "OK". The installation program will execute and guide you through the installation process. If installing from Windows Explorer, double click on the Setup.Exe file.

3. The program will prompt the user to identify the disk drive and directory where the COMPASS program will be stored. The default disk drive and directory is C:\COMPASS. After these questions have been answered, the installation program will create the directory and copy files from the CD to the hard disk.

The COMPASS program is now installed. The COMPASS CD can be removed from the computer.

2.3 Accessing Compass

COMPASS can be accessed by the following procedure first starting at the Windows START button: Start->Programs->Compass->CompWin. A shortcut to the COMPASS program that sits on a user's desktop can also be created. Use the following procedure to create a shortcut to the COMPASS program on the computers desktop: Right Click the mouse on any blank space on the desktop to bring up a menu; select new from the menu; select shortcut to bring up the new shortcut dialog box; select the browse button and browse to the COMPASS directory; select COMPWIN.EXE and click on open; type in a name where it asks you to give the new shortcut a name (i.e. COMPASS); click OK and the shortcut will be created.

2.4 Creating A Working Directory

In most cases, you will not want to create and store data files in the directory that contains COMPASS program files. Use Windows Explorer to create a folder for your data files. One can also select the <Create New Folder> button that appears on the <Open> and <Save As> dialog boxes within COMPASS.

RUNNING COMPASS

This section explains how to get data in and results out using the COMPASS software. The areas covered are file manipulation, entering and modifying data, generating results, viewing results, getting help, printing, modifying maintenance policies and saving your work.

The main screens encountered while running COMPASS are depicted in this section. Accompanying each screen is an explanation of the purpose of the screen and how the values for certain inputs may impact other screens.

3.1 Opening Screen

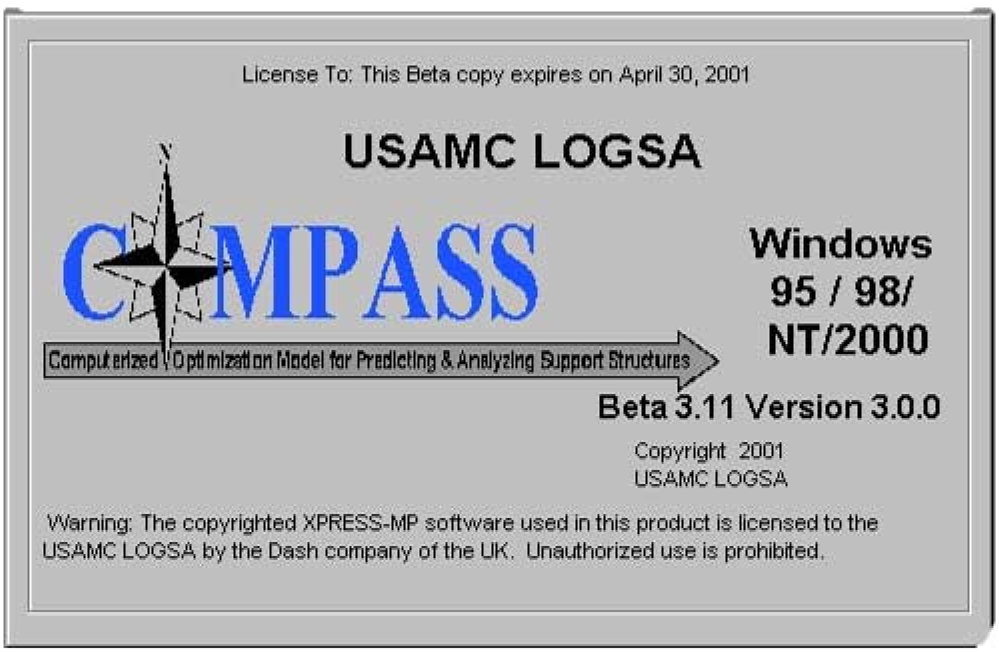


Figure 3-1

When COMPASS is executed, a screen similar to the one shown in Figure 3-1 will appear. This is the COMPASS opening screen. The screen identifies the version number and copyright information. Pressing any key or using the mouse to click on the screen will close this screen and continue to the main screen.

3.2 Main Screen

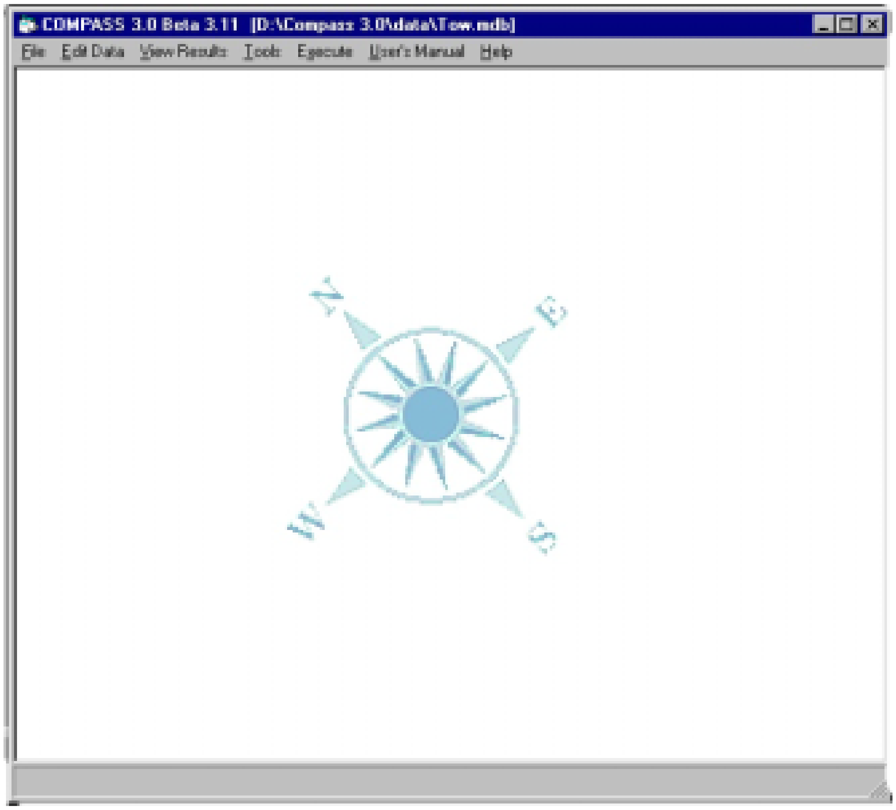


Figure 3-2

Figure 3-2 represents the COMPASS main screen. The menu bar displays the following categories File, Edit, View, Tools, Execute, User's Manual and Help. To select a category, use the mouse pointer and click on the selection. One can also use keyboard commands such as <ALT - F> so select the file menu for example. Immediately after entering COMPASS, the Edit, View, Tools and Execute commands will not be available to the user. The lettering of these commands will be gray in color to signify that they are not available. A file must be open in order to execute these commands. Whenever a file is open, the files name and path will be displayed in the title bar area as shown in Figure 3-2.

3.3 File

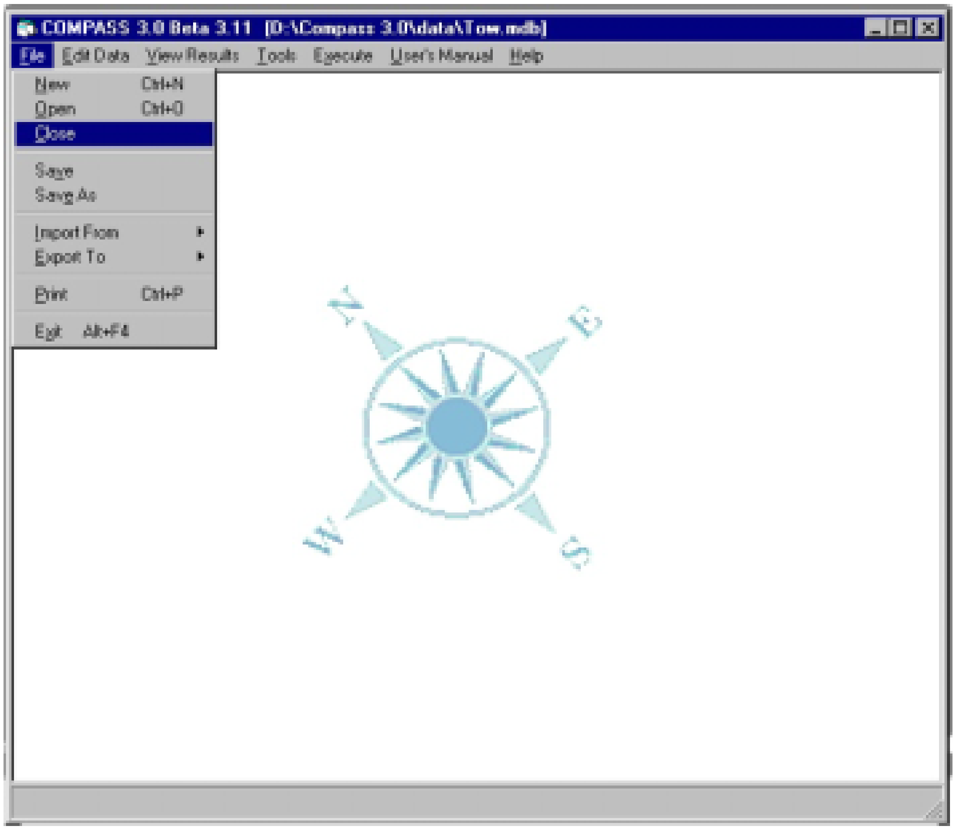


Figure 3-3

The COMPASS FILE menu is shown in Figure 3-3. Options within this menu include: creating a new file, opening an existing file, saving an open file, saving a file as a different name, closing the currently opened file, importing a file, exporting a file, or exiting COMPASS. A brief description of these functions is provided below.

The <NEW> command is used to create a new file. All input filenames should conform to the 8.3 DOS standard. The reason for the DOS naming standard is that parts of COMPASS (i.e. the FEA module, the formulator module, the evaluator module) are holdovers from the previous DOS versions. The modules can't accept the long filenames that are allowed by Windows. The model will automatically include the [.mdb] extension.

After the new file has been named and saved, COMPASS will automatically open the <Edit> -> <System Information> data input screen. The user is forced to complete the information in the <System Information> screen first because this information determines the inputs that included in subsequent screens. Once the <System Information> is completed, all other data may be entered in any order.

The <OPEN> command is used to access an existing file. When this command is selected, COMPASS will present the open file dialog box. The user can navigate through the computers directory structure until they find the desired file and then select the file. The file can be selected by either double-clicking on the file name with the mouse pointer or by single clicking on the file name and the selecting the <OPEN> button. The message area at the top of the COMPASS main screen will change to show the path and filename of the selected file. Figure 3-4 shows and example of the open file dialog box.

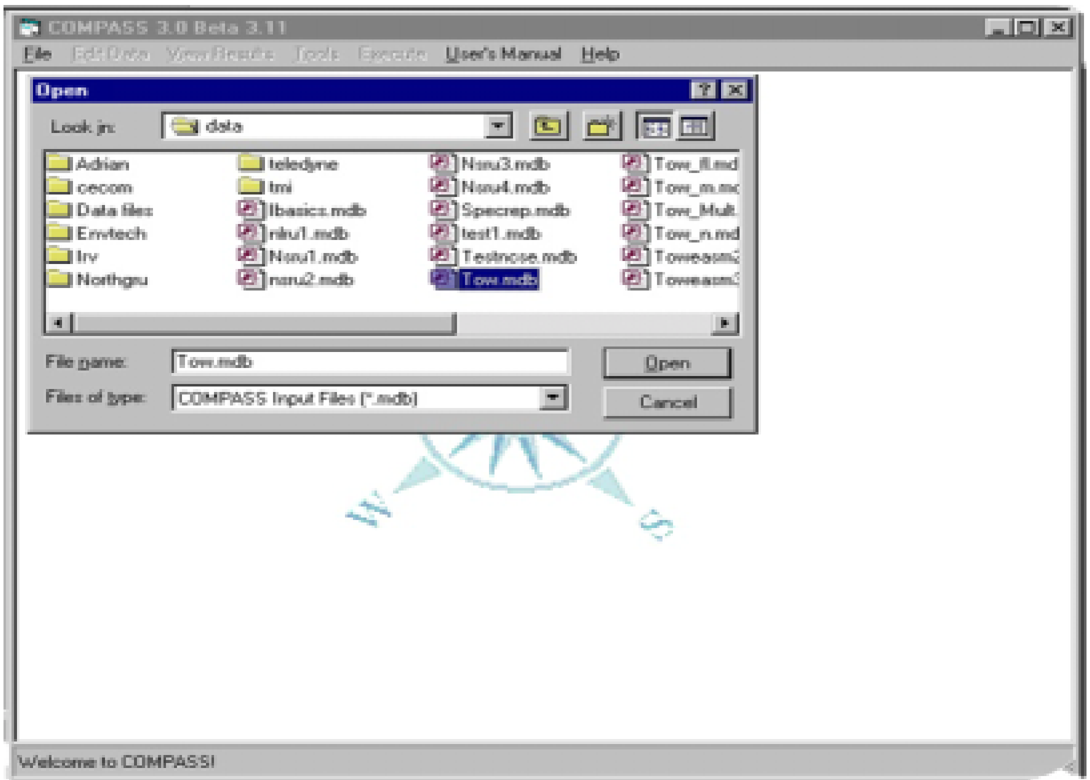


Figure 3-4

The <SAVE FILE> command is used to save the currently open data file using the files name. The <SAVE FILE AS> will open a dialog box similar to the one in Figure 3-4. The user can change directories and then type in the desired name for the file.

The <CLOSE> selection will close the current file. This command will not exit COMPASS.

The <Import From> selection will import an input file from another program or a previous version of COMPASS. The imported file is converted into the current COMPASS format. Selecting <Import From> brings up a menu containing a list of supported program as shown in Figure 3-5. Once a program selection is made, the open file dialog box is displayed. After the user makes their selection, the file is converted and the “Save As” dialog box is displayed. A name for the file is entered and the file is saved to the hard drive and is available for use.

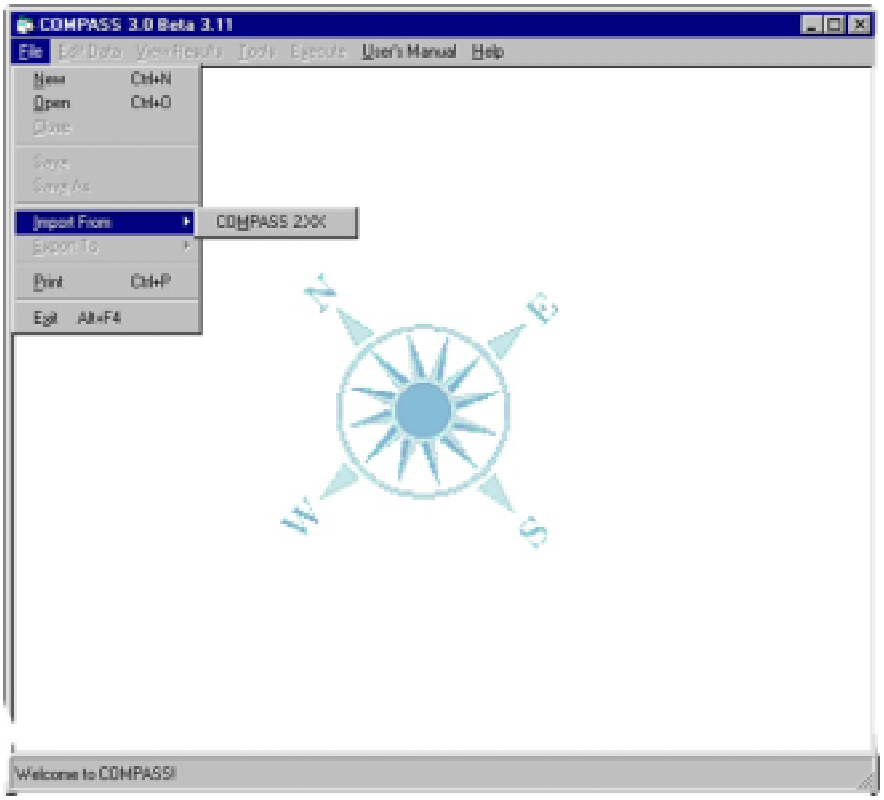


Figure 3-5

The <Export To> selection will convert the current COMPASS input file to a selected file format. Once <Export To> is selected, a menu that lists the supported file formats is displayed. After a file format is selected, the "Save" dialog box is displayed (Figure 3-6) and after a file name is entered the file is saved.

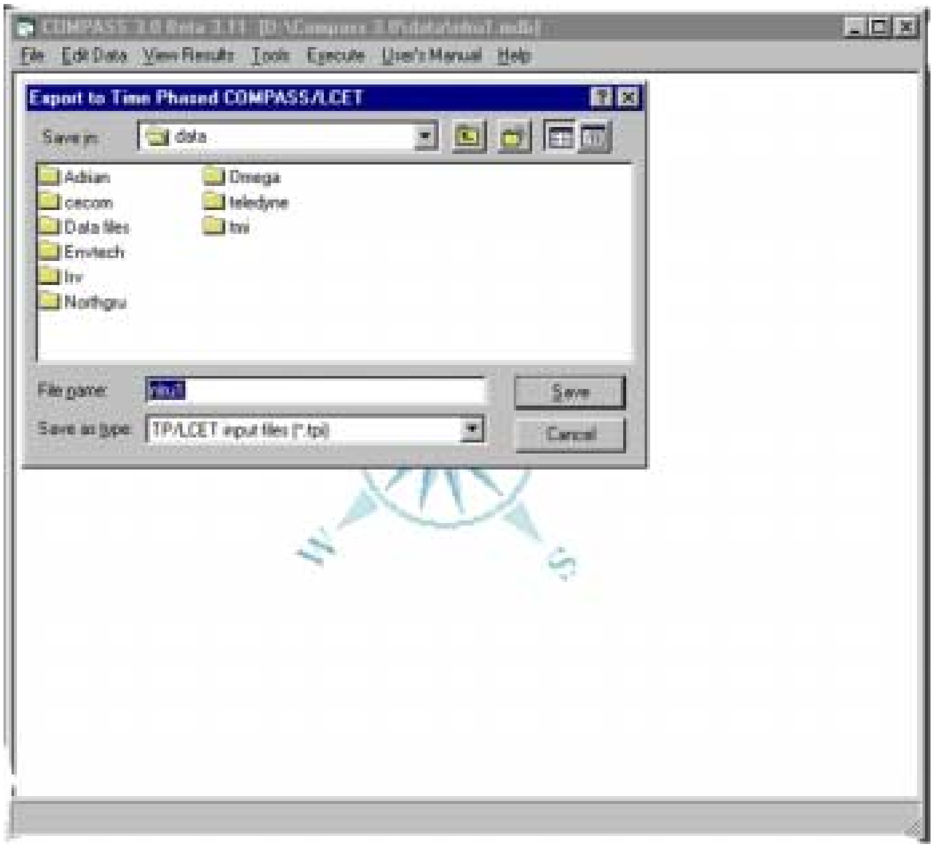


Figure 3-6

The <EXIT> command will terminate the COMPASS program. If one attempts to exit before saving a file that was modified, COMPASS will display a prompt that will give the user will be given an option to save the file and exit or exit without saving.

3.4 Edit Data

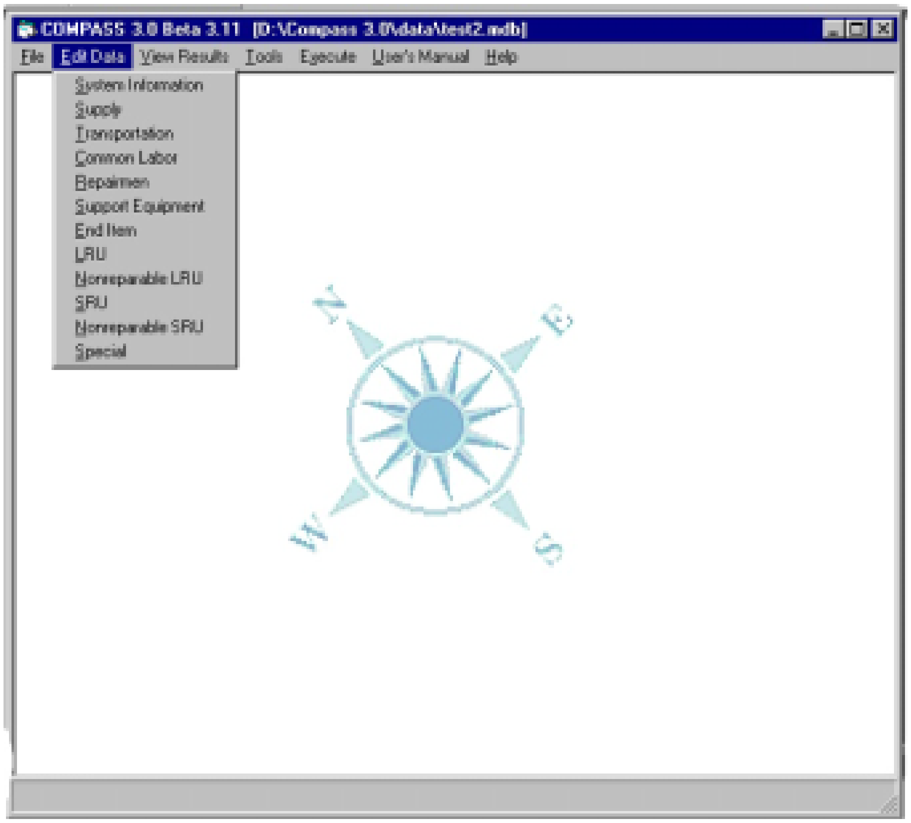


Figure 3-7

The Edit Data menu is used to add or modify data to a new or existing data file. Figure 3-7 displays the 12 categories that comprise the Edit Data menu. Use the mouse pointer to highlight the desired category and click the selection to open it. To exit any data entry screen, click on the "**x**" in the upper right corner of the screen. The data will be saved to memory. The user must use the SAVE FILE or SAVE FILE AS options to permanently save the edited data to disk. Otherwise, all changes that were stored in temporary memory will be lost when the file is closed or COMPASS is exited.

3.4.1 System Information

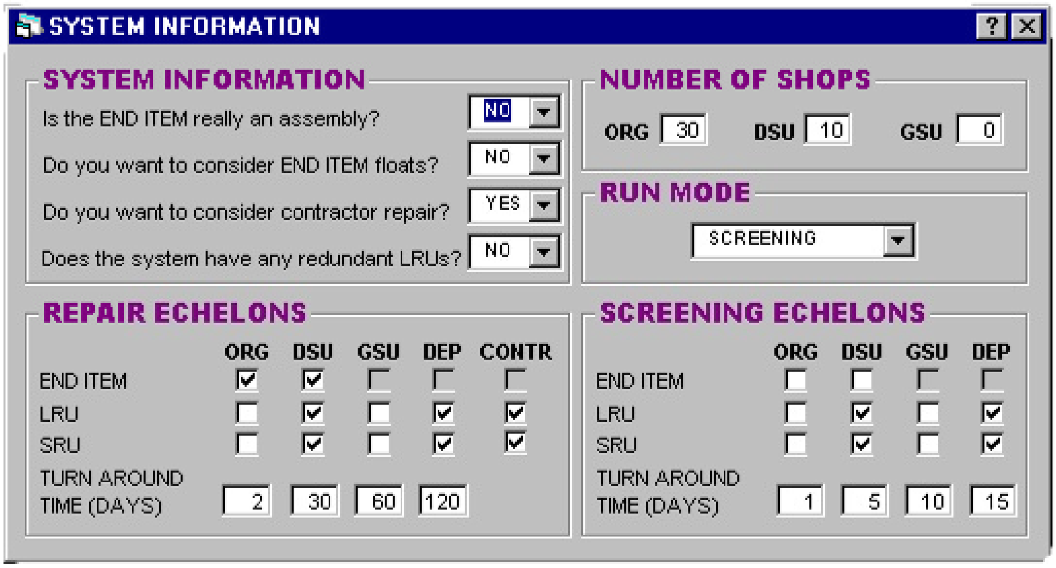


Figure 3-8

The SYSTEM INFORMATION screen is shown in Figure 3-8. The purpose of the information contained in this screen is to set flags for future screens. How the questions are answered dictates the inputs COMPASS asks for on future screens. When creating a new input file, the SYSTEM INFORMATION screen must be completed before any other screens can be accessed. The turnaround time inputs will serve as default parameters on all future LRU and SRU screens. The turnaround times may be tailored for each specific LRU/SRU in the appropriate input screen. Section 5.2 discusses the effect that SYSTEM INFORMATION inputs have on the other input data screens. The SYSTEM ECHELON PLACEMENT screen shown in Figure 3-8 is representative of a SCREENING run. The Screening Echelons portion of the SYSTEM INFORMATION is inaccessible for a Run Mode of NORMAL or MULTIPLE REPAIR.

3.4.2 Supply

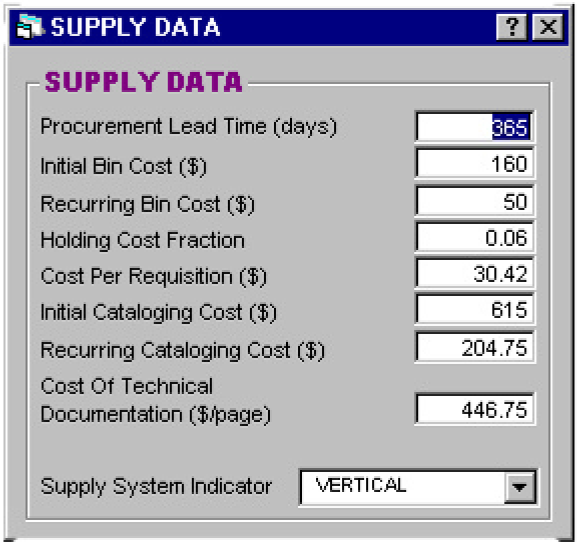


Figure 3-9

Supply Data is shown in Figure 3-9. These inputs are used by the SESAME supply algorithms within COMPASS to determine stockage requirements of all LRUs and SRUs at each of the maintenance levels. The stockage requirements are based on the operational availability goal. The operational availability goal is entered by the user in the End Item Data screen, shown in Figure 3-14.

A majority of these inputs will not vary from system to system. For this reason, each of these inputs has a default value that is contained in the COMPASS default file. If a more accurate value can be obtained for the system being modeled, it should be used in lieu of the default parameter.

If the user answers “**No**” to the question, "**Do you want to spare to availability?**" on the SPECIAL ANALYSIS screen (shown in Figure 3-28), the following two additional inputs will appear on this screen: Retail Stockage Criteria and Operating Levels by Echelon. Retail Stockage Criteria is the number of demands per year a location must have in order to be eligible to stock the item. Operating level is the number of days of stockage a location must have to sustain normal operation.

3.4.3 Transportation

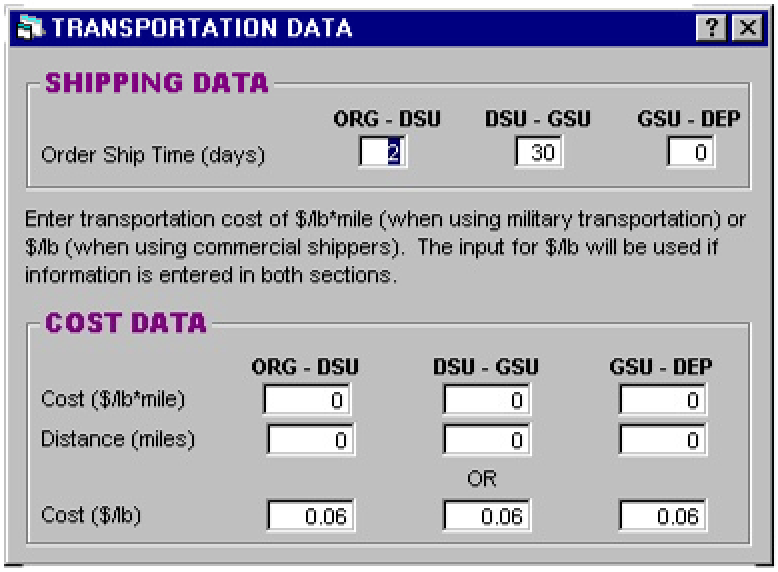


Figure 3-10

Information pertaining to the shipment of items to and from maintenance echelons is included in Figure 3-10. The user has two options for entering transportation information. The first option is to input the cost per pound per mile between maintenance echelons and the average distance between echelons. COMPASS will then internally compute the transportation cost per pound by multiplying these two inputs together. COMPASS will not display the result of the computation on this screen. It will be displayed, however, on the Front-End Analysis output report. The second method of entering transportation data is to fill in the cost per pound fields. If this alternative is chosen, no data should be included with the first cost per pound per mile and distance inputs. If data is included with all three inputs, COMPASS will only read the data contained in the cost per pound field. In situations where a maintenance level is not being considered, the user should input a zero (0) for the Order/Ship Time (OST) from the missing level to the next higher level. In the example shown in Figure 4-6, there is no GSU level. Therefore, the OST for the GSU-Depot column is zero. COMPASS will interpret this as a 30 day OST from DSU-Depot. Likewise, if there were a two level maintenance scheme consisting of the DSU and Depot, the ORG-DSU and GSU-Depot inputs would both be zero.

3.4.4 Common Labor

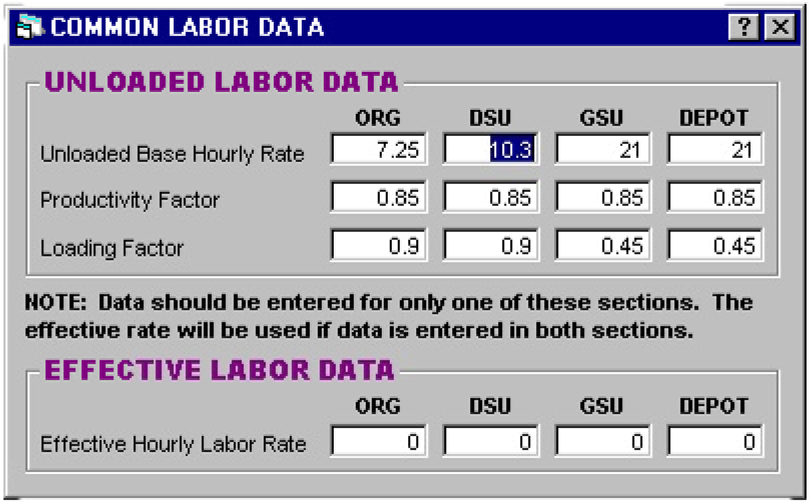


Figure 3-11

Figure 3-11 contains COMMON LABOR information. COMPASS assumes that for each maintenance action a repairman is needed. If a specific repairman is not identified by the user to perform the maintenance action, then the model will calculate the repair cost based on the effective hourly labor rate of a common repairman at the echelon where the maintenance is being performed. This cost is summarized in the output under the Common Labor Cost for LRUs and SRUs. It is also included within the Logistics Totals section.

The user has two options for entering the common labor data. The first option is to input an unloaded hourly rate, productivity factor, and loading factor. COMPASS will then compute an effective hourly rate internally. The second option is to input an Effective (i.e. Loaded) Hourly Labor Rate.

Data should not be included in both sections. If data is input in both sections, COMPASS will only read data contained in the Effective Hourly Rate section.

3.4.5 Repairmen

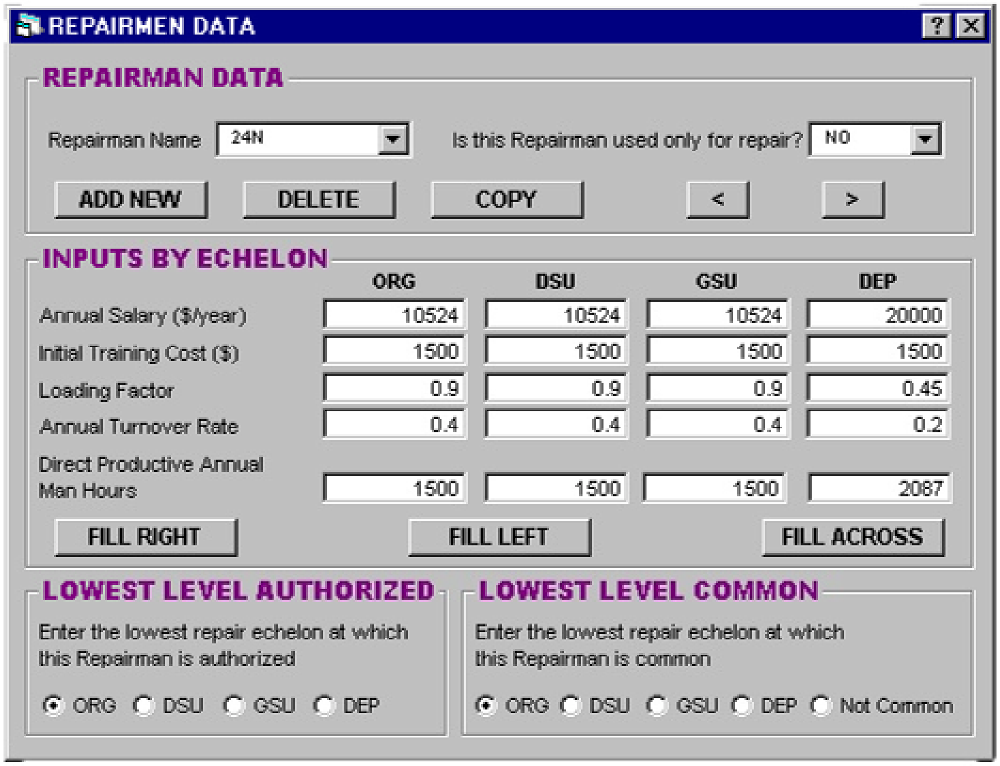


Figure 3-12

Repairman information is depicted in Figure 3-12. Data for each repairman must be entered separately. From this screen, the user may generate information on a new repairman, modify a repairman, copy information from a previously entered repairman, delete a repairman, or exit.

The user must click on the <Add New> button to add a new repairman. Failure to do so will result in lost information. Clicking the <Add New> button brings up the New Repairmen dialog box shown in Figure 3-13. Type in the name of the repairmen and click on the <OK> button and then start adding data.

In the Inputs by Echelon section, input the data in one of the maintenance echelons and press the <Fill Right>, <Fill Left>, or <Fill Across> key. This action will copy the same data in all cells to the right, left or across all of the cells in the row. Don’t do this if the data varies from cell to cell.

The only provision for restricting repairman placement at an echelon is via the “Lowest Echelon where Repairmen is Authorized” input. COMPASS will not attempt to place a repairman at a level lower than that which is specified by this input. At present, there is no direct input to exclude repairmen placement at a higher level than authorized. However, there is a method to accomplish the exclusion, as illustrated in the following example. Suppose the user provides data for a repairman called 27M and authorizes it at the DSU. COMPASS will consider placing the 27M at all levels higher than ORG. The user has been mandated to consider the 27M at the DSU and Depot levels only and must exclude the GSU. Extremely high costs (such as $9,999,999) should be input at the GSU level for the annual salary, training Cost, and turnover rate. The Direct Productive Annual Man-hours input should be very low (such as 10 hours) but not zero. These inputs will render placement of the 27M at the GSU economically unattractive, so only the DSU and Depot will be considered.

Figure 3-13

Clicking on the down arrow to the right of the Repairmen Name text box will display the list of repairmen that have been input. To select a repairman, click on the name from the list. To delete a repairman, first select the repairmen and then click the <Delete> button.

COMPASS allows for the information from one repairman to be copied to that of another. Clicking on the <Copy> button will bring up a dialog box similar to that shown in figure 3-13. Enter the name of the new repairman into the text field and click <OK>. The new repairman has been created. Make any necessary changes to information for the new repairman before moving on.

There are also two scroll buttons. These are located to the right of the <Copy> button and are shown as <Scroll Previous "<"> and <Scroll Next ">">.

3.4.6 Support Equipment

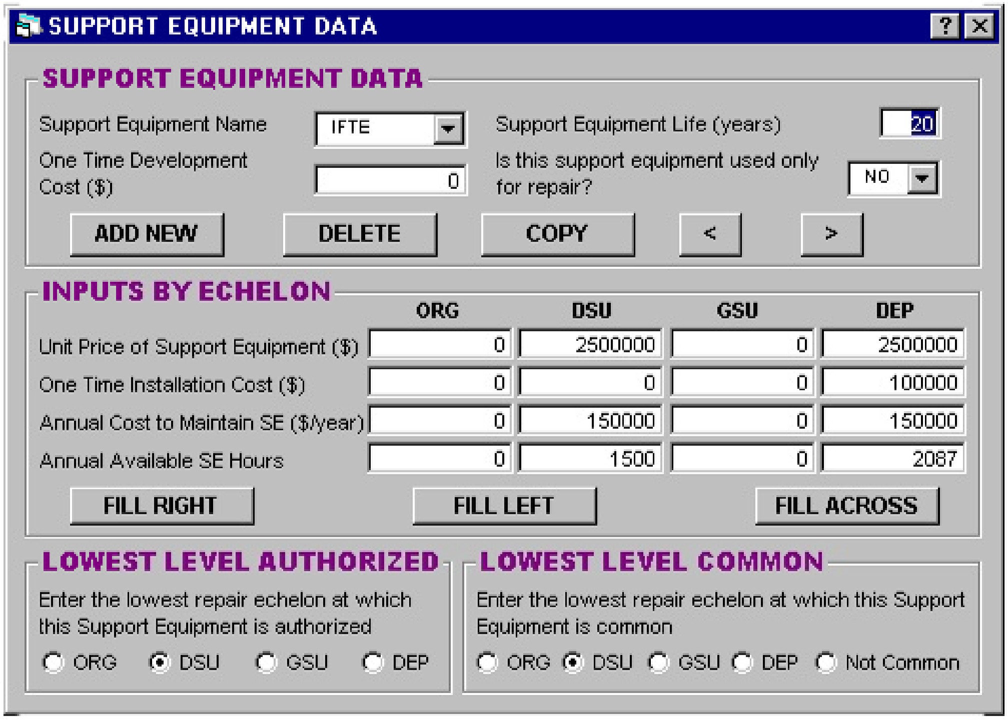


Figure 3-14

Support Equipment information is depicted in Figure 3-14. Data for each piece of support equipment must be entered separately. From this screen, the user may generate information on a new piece of support equipment, modify existing support equipment, copy information from a previously entered piece of support equipment, delete a piece of support equipment, or exit.

The user must click on the <Add New> button to add a new piece of support equipment. Failure to do so will result in lost information. Clicking the <Add New> button brings up the New Support Equipment dialog box similar to the new repairmen box shown in Figure 3-13. The name of the support equipment is typed into the text box, the <OK> button is clicked and new data can now be added.

In the Inputs by Echelon section, input the data in one of the maintenance echelons and press the <Fill Right>, <Fill Left>, or <Fill Across> key. This action will copy the same data in all cells to the right, left or across all of the cells in the row. Don’t do this if the data varies from cell to cell.

The only provision for restricting support equipment placement at an echelon is via the “Lowest Echelon where Support Equipment is Authorized” input. COMPASS will not attempt to place support equipment at a level lower than that which is specified by this input. At present, there is no direct input to exclude support equipment placement at a higher level than authorized. However, there is a method to accomplish the exclusion, as illustrated in the following example.

Suppose the user provides data for a piece of support equipment called IFTE and authorizes it at the DSU. COMPASS will consider placing the IFTE at all levels higher than ORG. The user has been mandated to consider the IFTE at the DSU and Depot levels only and must exclude the GSU. Extremely high costs (such as $9,999,999) should be input at the GSU level for the Unit Price, Installation Cost, and Annual Maintenance Cost. The Annual Available SE Hours input should be very low (such as 10 hours) but not zero. These inputs will render placement of the IFTE at the GSU economically unattractive, so only the DSU and Depot will be considered.

Clicking on the down arrow to the right of the Support Equipment Name text box will display the list of Support Equipment that have been input. To select a piece of support equipment, click on the name from the list. To delete a piece of support equipment, first select the support equipment and then click the <Delete> button.

COMPASS allows for the information from one piece of support equipment to be copied to that of another. Clicking on the <Copy> button will bring up a dialog box similar to that shown in figure 3-13. Enter the name of the new piece of support equipment into the text field and click <OK>. The new piece of support equipment has been created. Make any necessary changes to information for the new support equipment before moving on.

There are also two scroll buttons. These are located to the right of the <Copy> button and are shown as <Scroll Previous “<”> and <Scroll Next “>”>.

3.4.7 End Item

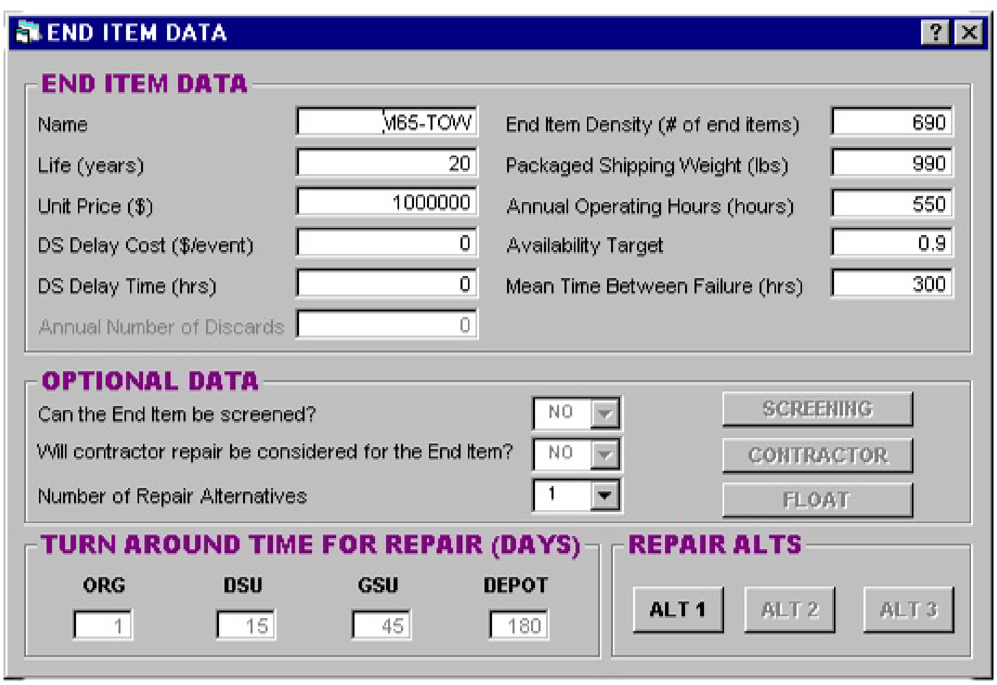


Figure 3-15

Information about the end item is shown in Figure 3-15. Questions on this screen that need to be filled in may vary depending on how questions were answered on the system information screen. In the example above, several buttons and inputs are “**grayed out**” and thus inaccessible.

As shown here, the last two questions, “DS Delay Cost” and “DS Delay Time,” will only appear if the user answered “Yes” to end item repair at the DSU on the Repair Echelon section of the System Information screen as depicted in Figure 3-8. These inputs will be “grayed out” if the user answered “Yes” to "Is the end item really an assembly."

When the question “Is the End Item really an Assembly” is answered “Yes”, then an input called, "Annual Number of Discards" will become accessible on the end item screen. The inputs for Turn Around Time (Days), at each echelon, will also become accessible when this question is answered with a “Yes”.

Answering, “Yes” to “Do you want to consider end item floats?” will also display the input called "Annual number of discards" on the end item screen. The **<Float>** button is also enabled. Clicking on the **<Float>** will pop up the End Item Float dialog box as shown in Figure 3-16.

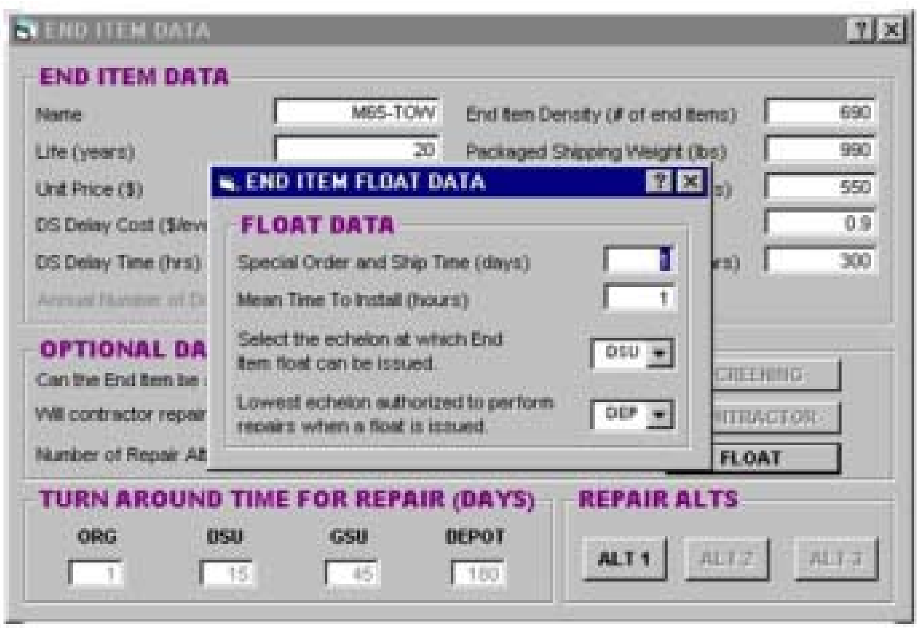


Figure 3-16

Another optional question that may appear on the End Item Screen (Figure 3-15) is "Will Contractor Repair be considered for the End Item?" This question will only appear if the question "Do you want to consider contractor repair?" was answered “Yes” on the system information screen, and End Item contractor Repair checked under the question "Repair Echelons” section.

An End Item Float refers to a spare end item that may replace the faulty end item when it fails. The float does not have to be issued with every failure. The user identifies the LRUs and

NLRUs that will invoke the issuance of an end item float. The End Item Float data affects the operational availability of the end item, stockage of all items, and determination of where to repair each item. COMPASS will calculate the required number of floats to be procured.

3.4.8 LRU

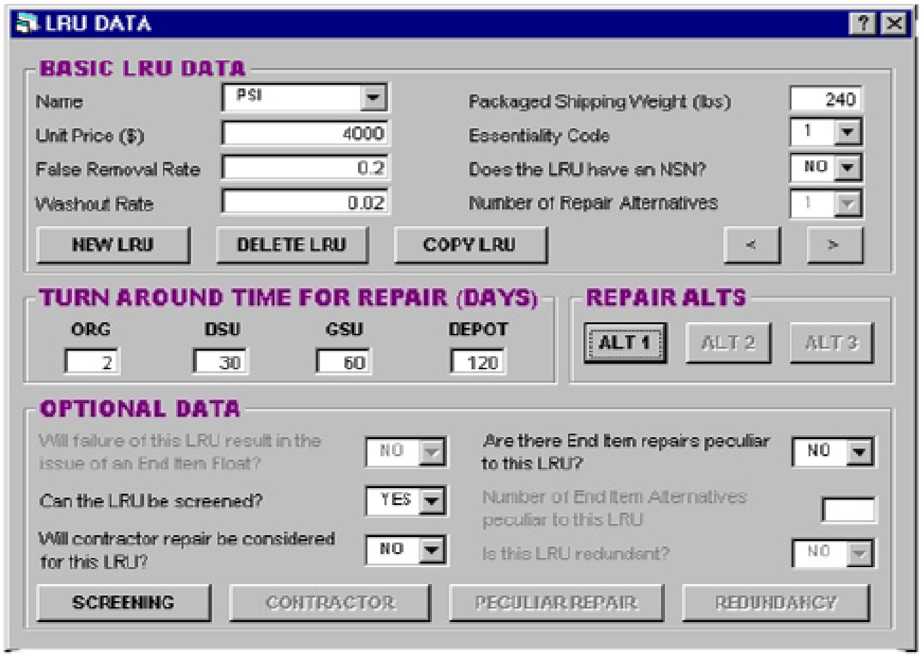


Figure 3-17

The LRU data screen is shown in Figure 3-17. This screen, plus the Repair alternative for LRU (similar to Figure 4-15), must be completed for each LRU. No two LRUs may have the same name. An LRU is an item that is removed and replaced to restore the end item to an operationally ready condition. From this screen, the user may generate information on a new LRU, modify an existing LRU, copy information from a previously entered LRU, delete an LRU, or exit.

The user must click on the <Add New> button to add a new LRU. Failure to do so will result in lost information. Clicking the <Add New> button brings up the New LRU dialog box similar to the new repairmen box shown in Figure 3-13. The name of the LRU is typed into the text box, the <OK> button is clicked and new data can now be added.

Clicking on the down arrow to the right of the LRU Name text box will display the list of LRUs that have been input. To select an LRU, click on the name from the list. Modifying existing data can take place once the desired LRU has been selected. To delete a repairman, first select the repairmen and then click the <Delete> button.

COMPASS allows for the information from one LRU to be copied to that of another. Clicking on the <Copy> button will bring up a dialog box similar to that shown in figure 3-13. Enter the name of the new LRU into the text field and click <OK>. The new LRU has been created. Make any necessary changes to information for the new LRU before moving on.

There are also two scroll buttons. These are located to the right of the <Copy> button and are shown as <Scroll Previous “<”> and <Scroll Next “>”>.

All questions in the Optional Data section will vary, depending on how certain questions were answered on the SYSTEM INFORMATION screen. Explanations and definitions of the inputs are in Appendix A.

3.4.9 Non-Reparable LRU (NLRU)

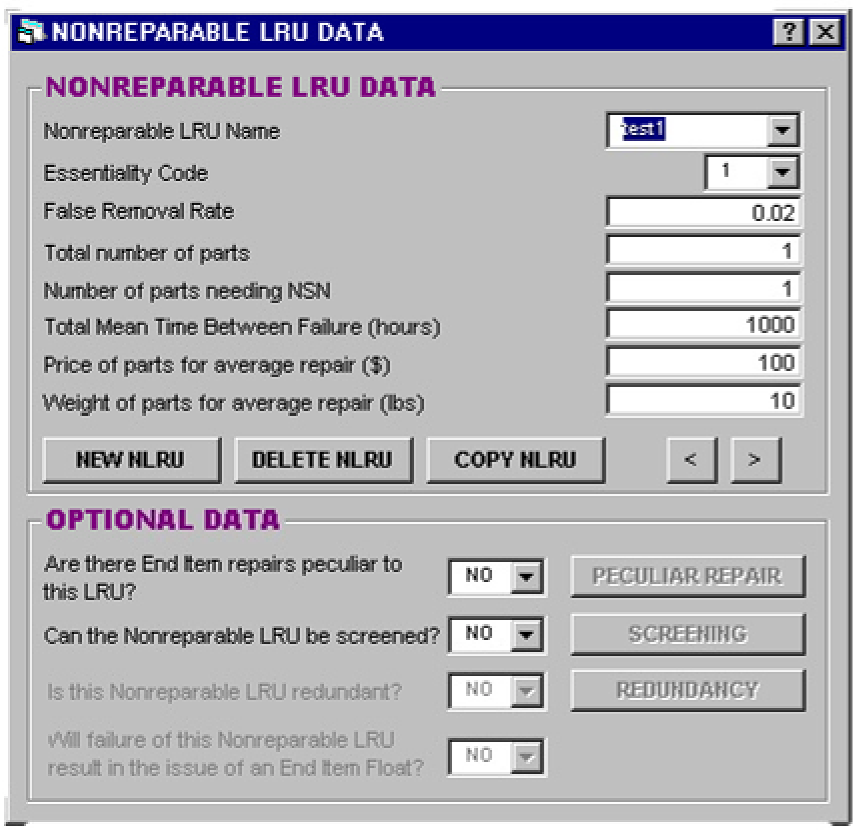


Figure 3-18

The NLRU data screen is shown in Figure 3-18. This screen must be completed for each NLRU. No two NLRUs may have the same name. A NLRU is an item that is removed and replaced to restore the end item to an operationally ready condition. Unlike an LRU, this item will discarded at failure (i.e., automatic throwaway). Since an NLRU doesn’t have any lower indentured items, an MTBF is required. From this screen, the user may generate information on a new NLRU, modify an existing NLRU, copy information from a previously entered NLRU, delete an NLRU, or exit.

The user must click on the <Add New> button to add a new NLRU. Failure to do so will result in lost information. Clicking the <Add New> button brings up the New NLRU dialog box similar to the new repairmen box shown in Figure 3-13. The name of the NLRU is typed into the text box, the <OK> button is clicked and new data can now be added.

Clicking on the down arrow to the right of the NLRU Name text box will display the list of NLRUs that have been input. To select an NLRU, click on the name from the list. Modifying existing data can take place once the desired LRU has been selected. To delete a repairman, first select the repairmen and then click the <Delete> button.

COMPASS allows for the information from one NLRU to be copied to that of another. Clicking on the <Copy> button will bring up a dialog box similar to that shown in Figure 3-13. Enter the name of the new NLRU into the text field and click <OK>. The new NLRU has been created. Make any necessary changes to information for the new NLRU before moving on.

There are also two scroll buttons. These are located to the right of the <Copy> button and are shown as <Scroll Previous “<”> and <Scroll Next “>”>.

All questions in the Optional Data section will vary, depending on how certain questions were answered on the SYSTEM INFORMATION screen. Explanations and definitions of the inputs are in Appendix A.

3.4.10 SRU

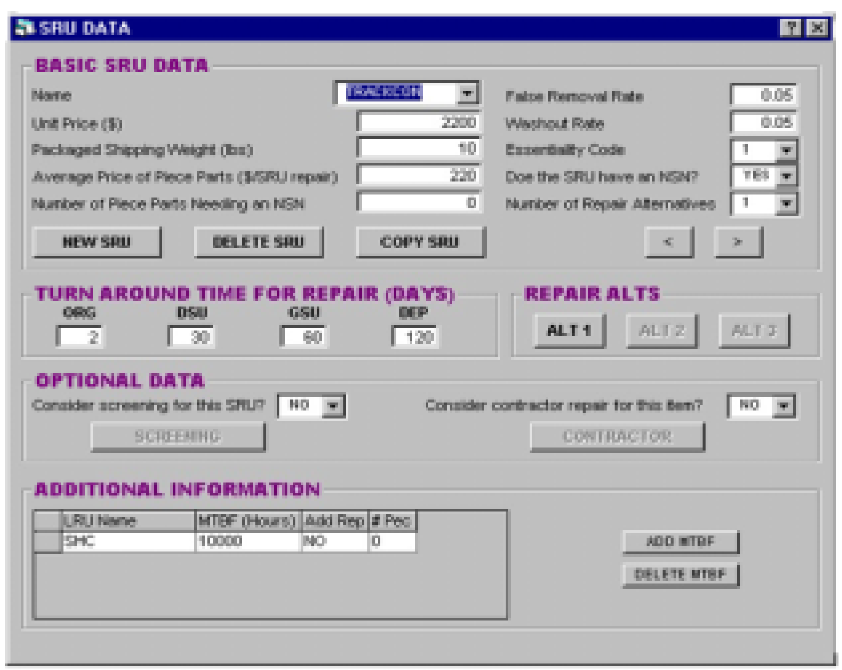


Figure 3-19

The SRU data screen is shown in Figure 3-19. This screen must be completed for each SRU. No two SRUs may have the same name. A SRU is an item that is removed and replaced to restore the LRU to an operationally ready condition. Two additional inputs required for the SRU are: “Average price of piece parts ($/SRU Repair);” and “No. of piece parts needing NSN.” Piece parts in COMPASS are items that are removed/replaced to fix an SRU. The piece parts are automatically discarded and not repaired. COMPASS does calculate the cost associated with these parts including bin, cataloging, and material costs. From this screen, the user may generate information on a new SRU, modify an existing SRU, copy information from a previously entered SRU, delete an SRU, or exit.

The user must click on the <Add New> button to add a new SRU. Failure to do so will result in lost information. Clicking the <Add New> button brings up the New NLRU dialog box similar to the new repairmen box shown in Figure 3-13. The name of the SRU is typed into the text box, the <OK> button is clicked and new data can now be added.

Clicking on the down arrow to the right of the SRU Name text box will display the list of SRUs that have been input. To select an SRU, click on the name from the list. Modifying existing data can take place once the desired LRU has been selected. To delete a repairman, first select the repairmen and then click the <Delete> button.

COMPASS allows for the information from one SRU to be copied to that of another. Clicking on the <Copy> button will bring up a dialog box similar to that shown in Figure 3-13. Enter the name of the new SRU into the text field and click <OK>. The new SRU has been created. Make any necessary changes to information for the new SRU before moving on.

There are also two scroll buttons. These are located to the right of the <Copy> button and are shown as <Scroll Previous “<”> and <Scroll Next “>”>.

All questions in the Optional Data section will vary, depending on how certain questions were answered on the SYSTEM INFORMATION screen. COMPASS needs to be told which LRU each SRU belongs too. SRU’s can belong to more than one LRU. Information on the Additional Information Screens is covered in a later section. Explanations and definitions of the inputs are in Appendix A.

3.4.11 Non-Repairable SRU (NSRU)

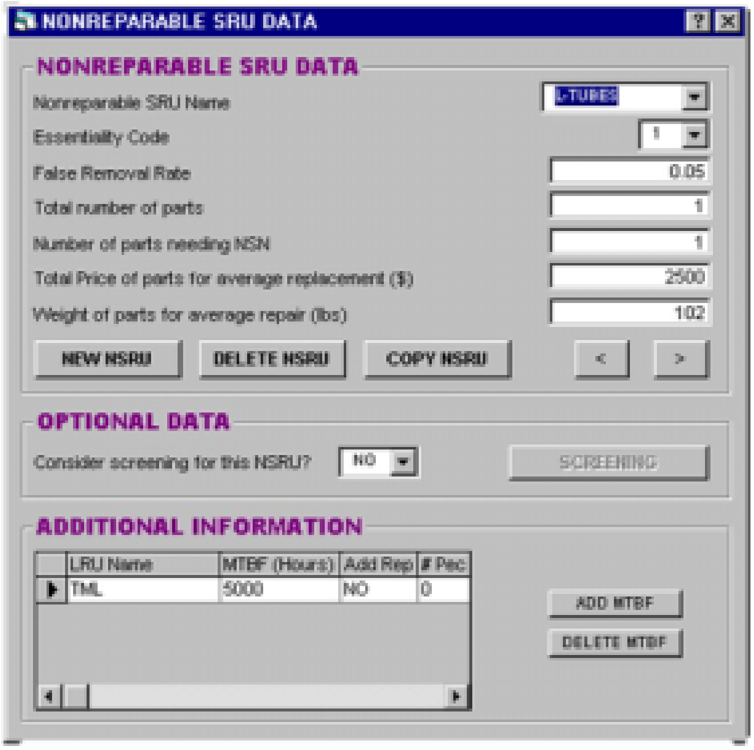


Figure 3-20

The NSRU data screen is shown in Figure 3-20. This screen must be completed for each NSRU. No two NSRUs may have the same name. A NSRU is an item that is removed and replaced to restore the LRU to an operationally ready condition. Unlike an SRU, this item will discarded at failure (i.e., automatic throwaway). For data reduction purposes, several parts with a similar function can be grouped together to form one NSRU. When parts are grouped together then the "**Total Number of Parts**" would equal to the number of parts grouped together to form the NSRU. The sparing quantity and costs will be multiplied by the number of parts. The "Total Price of parts for average replacement" is normally taken as the unit price of the NSRU, except when parts are grouped together. If the From this screen, the user may generate information on a new NSRU, modify an existing NSRU, copy information from a previously entered NSRU, delete an NSRU, or exit.

The user must click on the <Add New> button to add a new NSRU. Failure to do so will result in lost information. Clicking the <Add New> button brings up the New NLRU dialog box similar to the new repairmen box shown in Figure 3-13. The name of the NSRU is typed into the text box, the <OK> button is clicked and new data can now be added.

Clicking on the down arrow to the right of the NSRU Name text box will display the list of

NSRUs that have been input. To select an NSRU, click on the name from the list. Modifying existing data can take place once the desired LRU has been selected. To delete a repairman, first select the repairmen and then click the <Delete> button.

COMPASS allows for the information from one NSRU to be copied to that of another. Clicking on the <Copy> button will bring up a dialog box similar to that shown in Figure 3-13. Enter the name of the new NSRU into the text field and click <OK>. The new NSRU has been created. Make any necessary changes to information for the new NSRU before moving on.

There are also two scroll buttons. These are located to the right of the <Copy> button and are shown as <Scroll Previous “<”> and <Scroll Next “>”>.

All questions in the Optional Data section will vary, depending on how certain questions were answered on the SYSTEM INFORMATION screen. As with an SRU, COMPASS needs to know the LRUs that the NSRU belongs too. NSRUs can belong to more than one LRU. Information on this is included in the “Additional Information Screens” that are covered in a later section. Explanations and definitions of the inputs are in Appendix A.

3.4.12 Special

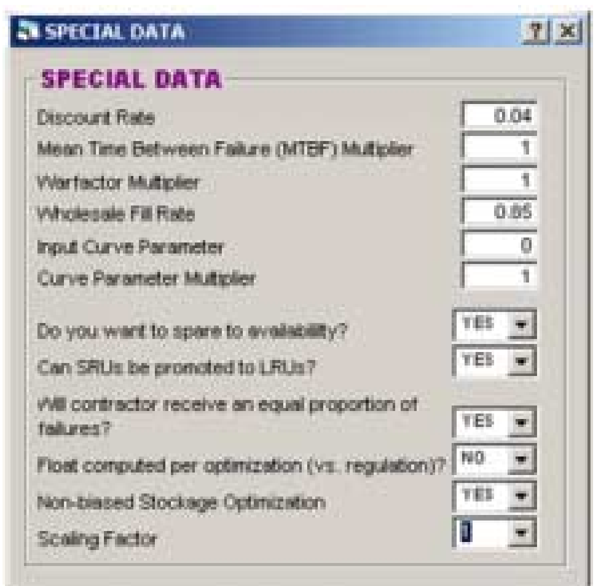


Figure 3-21

Figure 3-21 contains inputs that are mostly default values. The exceptions are “Warfactor” and “MTBF Multiplier” which can be used for sensitivity studies. The “Scaling Factor” is used to globally scale the costs in the input file. Factors available for use are 100,10, 1(default), 0.1, and 0.01. The scaling factor is most often used when the error message “a output cost exceeded a billion dollars” occurs.

The billion-dollar error is due to a limitation in the Evaluator routine, which is a holdover from version 2.3. The limitation will be eliminated in a future version. The scaling factor works in the background to overcome the evaluator limitation and is transparent to the user. The output costs in the FEA, Optimizer, and Evaluator reports reflect the actual costs in the input file. For the most part, these inputs will not have to be changed. For more information on these parameters, refer to the help screens or Appendix A.

3.4.13 Repair Alternative

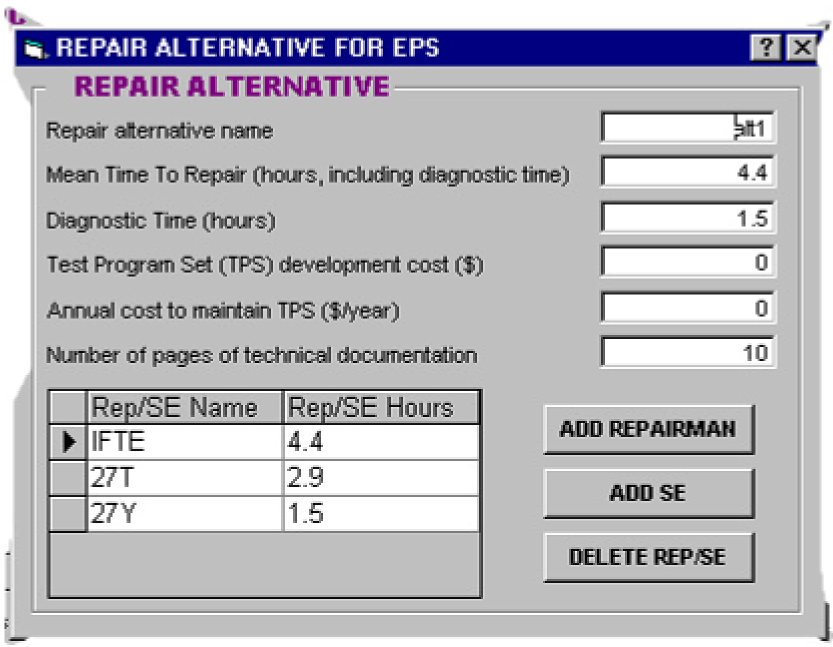


Figure 3-22

The Repair Alternative screen is shown in Figure 3-22. This screen is common to the End Item, LRU, and SRU. This screen is accessible by clicking on the <Alt 1>, <Alt 2>, or <Alt 3> buttons that appear in the “Repair Alts” section of each repairable item. Note that <Alt 2> and <Alt 3> are only accessible if the Run Mode on the System Information Screen is set to “Multiple Repair” and the “Number of Repair Alternatives” on each item’s screen is set to something other than 1.

Information contained on this screen pertains to resources required to repair the item. All SE and repairmen required to perform the repair of this item should be identified along with the amount of time their services are required. Time (hrs) does not have to correspond to the Mean Time to Repair (MTTR), but in most cases, it will. If it is not known who or what will be used to repair the item, then the “Rep/SE Name” and “Rep/SE Hours” fields can be left blank. COMPASS will compute a common labor cost using the MTTR and listed on the screen and the common labor rate for each echelon. The MTTR is a required input.

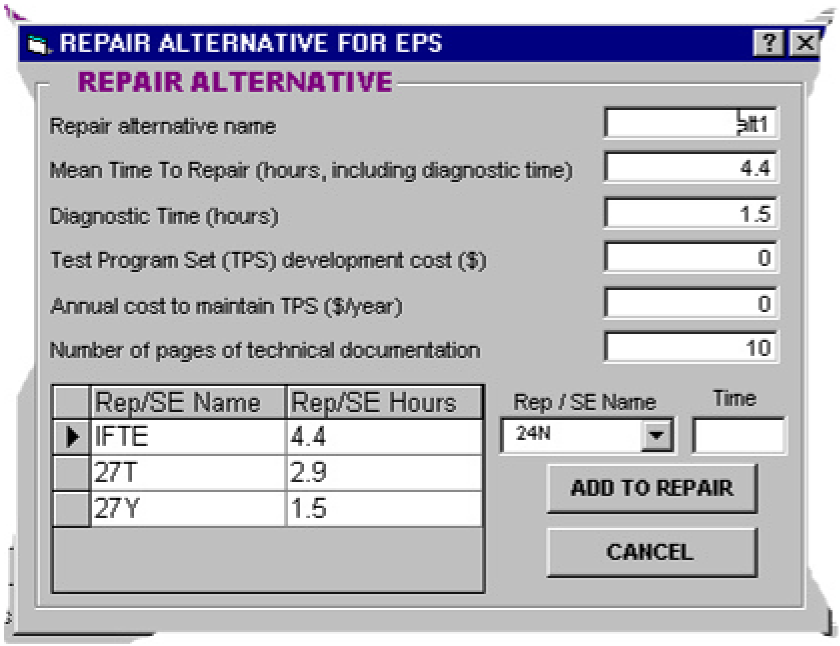


Figure 3-23

Click on the <Add Repairmen> or the <Add SE> buttons to add repairmen or support equipment. This action will bring up the appropriate list of either repairmen or support equipment as shown in Figure 3-23. Select the appropriate Repairmen/SE from the dropdown list, enter the time used in the appropriate box and click <Add to Repair>. To delete repairman or support equipment, click on the <Delete Rep/SE> (Figure 3-22) button to bring up the "Rep/SE" list (Figure 3-24), select, and click <Remove>.

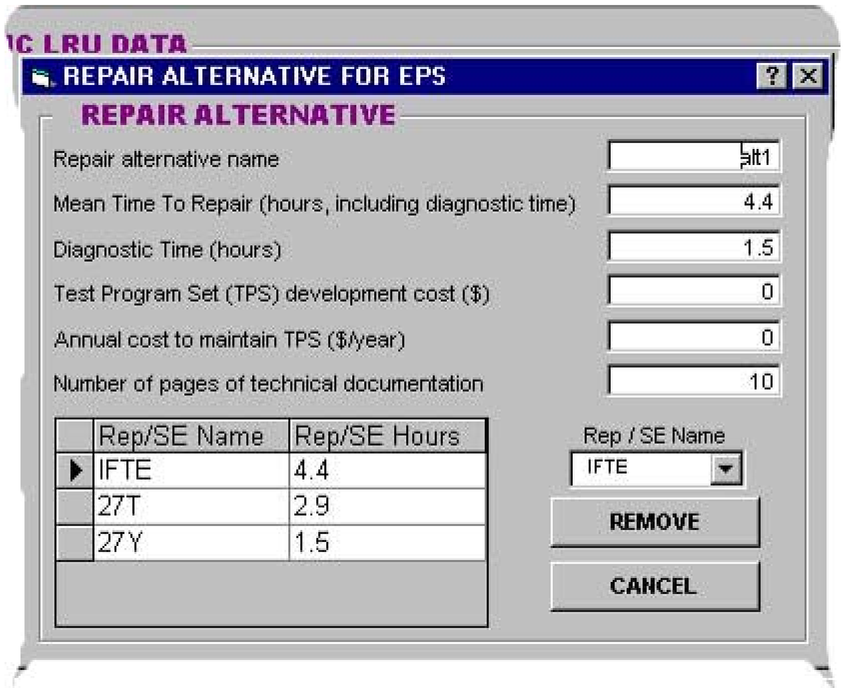


Figure 3-24

3.4.14 Screening

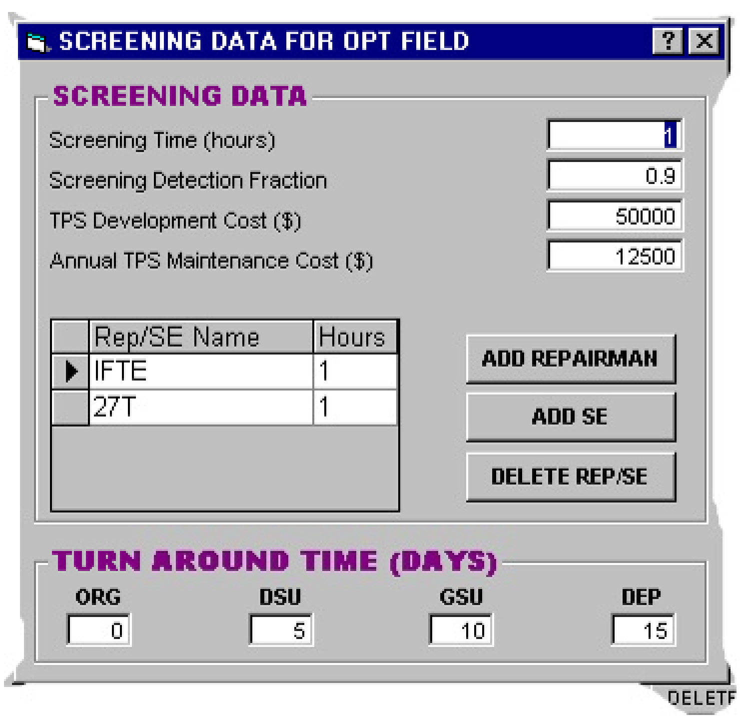


Figure 3-24

The screening information screen is shown in Figure 3-24. Screening is a separate diagnostic test that is performed to catch items that have been removed but are still good. This is known as a false removal. Screening is also refereed to as “Go/No Go Testing”. During a Screening run, COMPASS will determine the economics of only repairing or discarding the item or screening the item first and then repairing or discarding. If screening is economical, COMPASS will identify at which location the screening procedure should take place along with the maintenance level where repair or discard should occur.

In order for this screen to appear, the "Run Mode" input on the SYSTEM INFORMATION screen needs to be set to “**Screening**”. The question, "Can the item be screened" will become enabled on the end item, LRU, NLRU, SRU, and NSRU screens. Answering, “Yes” to this question will enable the <Screening> button. Clicking on <Screening> will bring up Figure 3-24. The user does not have to answer, “Yes” for all items. Most likely, the user will have a mixture upon which some items are considered for screening, and some not considered.

All SE and repairmen required to perform screening of this item should be identified along with the amount of time their services are required. Time (hrs) for repairmen and SE does not have to correspond to the screening time, but in most cases, it will. If it is not known who or what will be used to repair the item, then the “Rep/SE Name” and “Rep/SE Hours” fields can be left blank. COMPASS will compute a common labor cost using the Screening Time listed on the screen and the common labor rate for each echelon.

Click on the <Add Repairmen> or the <Add SE> buttons to add repairmen or support equipment. This action will bring up the appropriate list of either repairmen or support equipment as shown above. Select the appropriate Repairmen/SE from the dropdown list, enter the time used in the appropriate box and click <Add to Repair>. To delete repairman or support equipment, click on the <Delete Rep/SE> (shown on the Repair Alternative screen) button to bring up the “Rep/SE” list (below), select, and click <Remove>.

Don’t forget to add numbers to the Turn Around Time at the bottom of the screen.

3.4.15 Contractor Repair

Figure 3-25

Contractor Repair information is shown in Figure 3-25. This is an optional repair alternative. A three-part process must be completed before this screen can be accessed. The first question, "Do you want to consider contractor repair" appears on the System Information screen. A "yes" answer to this question enables the "CNTR" check box under the "Repair Information" section of the System Information screen. This input allows the user to restrict which indenture levels will be considered for contractor repair (i.e., contractor repair of SRUs may be a viable alternative, but contractor repair of LRUs may be undesirable). Select the desired indenture level (i.e. End Item, LRU, SRU) by clicking on its checkbox. This action will enable the "Do you want to consider Contractor Repair for this item" question for each selected item. Setting the second question to "yes" will enable the <Contractor> button under the Optional Data section of each item. Clicking on the <Contractor> button brings up the data entry screen. Note that Contractor repair of the end item is only valid if the end item is being modeled as an Assembly or Float.

In most cases, the echelon to ship to contractor and echelon shipped from contractor should be the same. Also, note that the transportation cost for contractor repair only reflects the cost involved in getting the item to and from the shipping point. Transportation charges between the shipping echelon and the contractor facility must be included in the Contractor Cost per Repair.

For each item the user completes contractor repair information, COMPASS will determine the economics of repairing the item at all of the viable maintenance echelons, the contractor facility, and discarding the item. It will identify the location at which maintenance is most economical.

3.4.16 LRU Redundancy

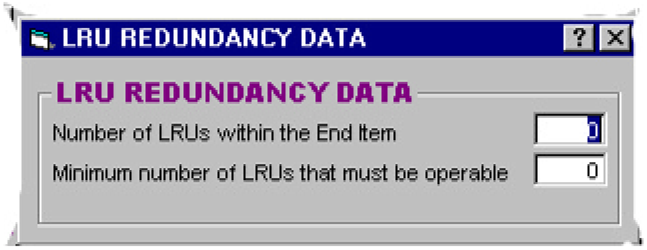


Figure 3-26

The LRU redundancy data screen is depicted in Figure 3-26. LRU Redundancy refers to the situation in which the end item may be comprised of more than one particular LRU. The end item isn't rendered inoperable because of a failure of one or more of the redundant LRUs. This is because one or more of the other redundant LRU(s) are still operational. The purpose of this type of configuration is to improve the operational availability of the system. This screen will only appear if the following is true: A "Yes" is input for "Does system have any redundant LRUs?" on the SYSTEM INFORMATION screen; and a "Yes" is input for the question "Is this LRU redundant?" on the LRU Basic Data screen or the NLRU data screen. Remember that not all LRUs are redundant.

COMPASS will not allow the user to issue a float (spare end item) when the item is identified as being redundant. If the user attempts to answer "Yes" to the following two questions: "Is this LRU redundant?" and "Will failure of this LRU result in issue of a float?" on the LRU and NLRU screen, COMPASS will pop up a warning message stating "LRU cannot be redundant and result in issue of a float." COMPASS will not allow the user to leave the LRU and/or NLRU screen until the answer to one of these two inputs has been modified.

LRU redundancy is not applicable if the user identifies the "end item as an assembly" on the SYSTEM INFORMATION screen. The user can not answer "Yes" to both of the following questions on the SYSTEM INFORMATION screen: "Is the end item really an assembly" and "Does system have any redundant LRUs."

3.4.17 Peculiar Repair

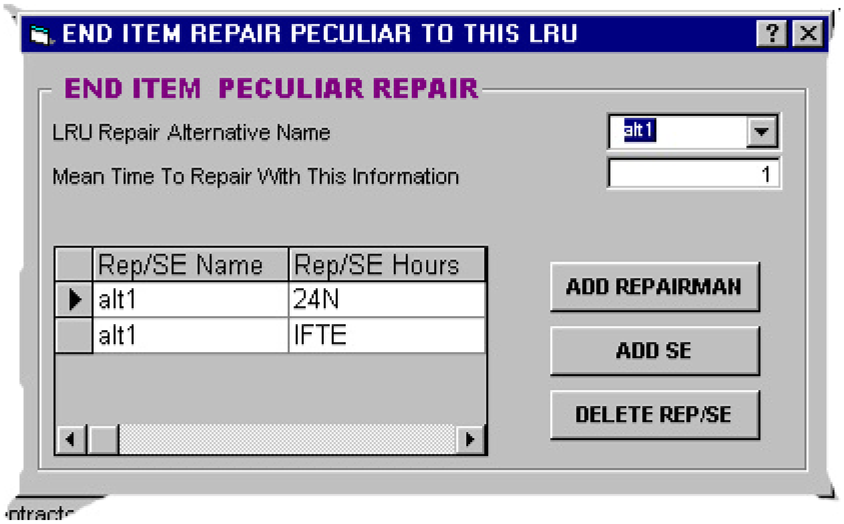


Figure 3-27

Figure 3-27 represents the screen for end item repair particular to an LRU. This screen pertains to some instances where there may be certain SE and/or repairmen that are not required every time the end item fails, but may be required only when certain LRUs fail. An example may be a piece of calibration equipment that is only needed to recalibrate the end item when a specific LRU fails. It is not needed to recalibrate the end item every time it fails.

To enable End Item Peculiar Repair first set the question “Are the End Item Repairs Peculiar to this LRU” to “Yes”. The question appears in the “Optional Data” section of the LRU data screen. This action enables the <Peculiar Repair> button at the bottom of the LRU data screen. Click on the <Peculiar Repair> button to display the screen shown in Figure 3-27.

Click on the <Add Repairmen> or the <Add SE> buttons to add repairmen or support equipment. This action will bring up the appropriate list of either repairmen or support equipment as shown in Figure 3-23. Select the appropriate Repairmen/SE from the dropdown list, enter the time used in the appropriate box and click <Add to Repair>. To delete repairman or support equipment, click on the <Delete Rep/SE> (Figure 3-22) button to bring up the “Rep/SE” list (Figure 3-24), select, and click <Remove>.

A similar scenario may also occur with SRU information. The question, "Add repair" will appear after the <Add MTBF> has clicked. The question will appear to the right of the MTBF data entry box. Setting the question to “Yes” and then clicking on <Assign MTBF> will display a screen similar to the one above. The question “Pages of Documentation saved if LRU Tossed” is added to the Peculiar Repair Screen for SRUs.

The data that must be entered on this screen is the MTTR and the required SE/Repairman for this particular repair action.

3.4.18 Adding MTBF to SRU/NSRU(s)

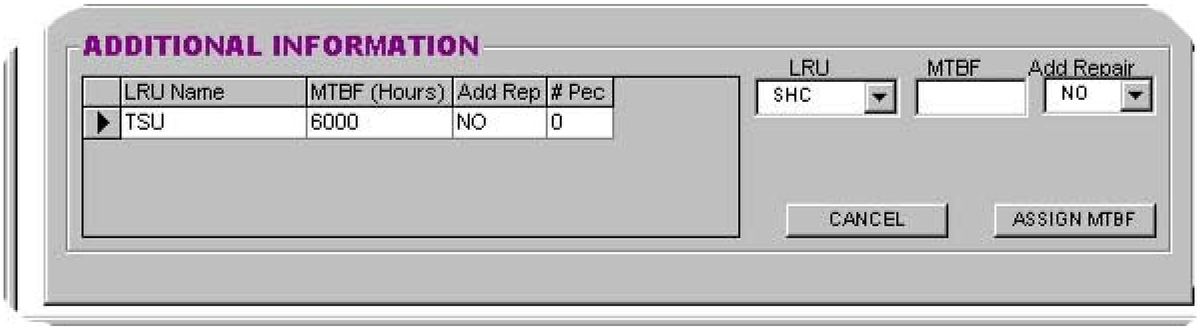


Figure 3-28

Figure 3-28 shows the screen that contains the MTBF data entry field. This screen appears only after the <Add MTBF> button is clicked on the bottom of SRU/NSRU data entry screens. Select the LRU that the SRU/NSRU is attached to, enter the MTBF value and click on the <Assign MTBF> button.

3.5 VIEW

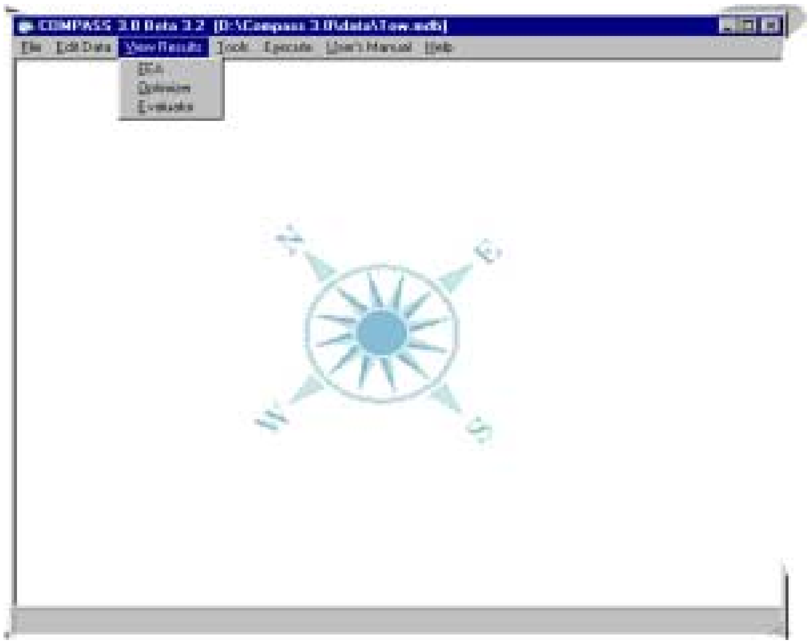


Figure 3-29

The “**View Results**” command is used to access the output files generated by COMPASS. To access this option, click the “**View Results**” category with the mouse button. This action will generate a drop-down menu shown above. If there is, a current report available (i.e. a COMPASS FEA, Optimizer, or Evaluator run has been completed) for the input then clicking on one of the report categories will display the report. If not, then an open file dialog box will be displayed as shown below. The example shows the open dialog box for FEA reports with the extension ***.fea**. The optimizer and evaluator reports have the extensions ***.opt** and ***.eva**. Note that all the COMPASS reports and input files are formatted using the Microsoft Access 97 format.

Figure 3-30

3.6 TOOLS

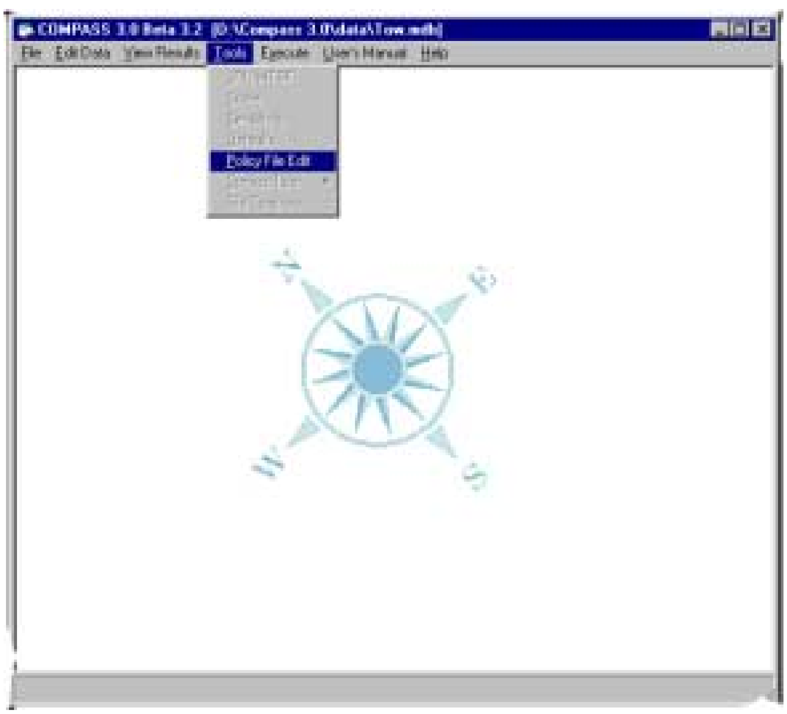


Figure 3-31

The TOOLS menu (shown above) of COMPASS provides additional procedures not directly related to generating/editing or executing input files. So far, only one tool has been implemented for this version. Others will be added at a later data.

The <**Policy File Edit**> is a feature that is used when conducting sensitivity analysis. This option allows the user to modify the maintenance concept of a weapon system. The Evaluator is then executed to determine the effects of altering the maintenance concept. The output file generated by executing the Evaluator is denoted by an [.EVA] extension.

3.6.1 Edit Policy File

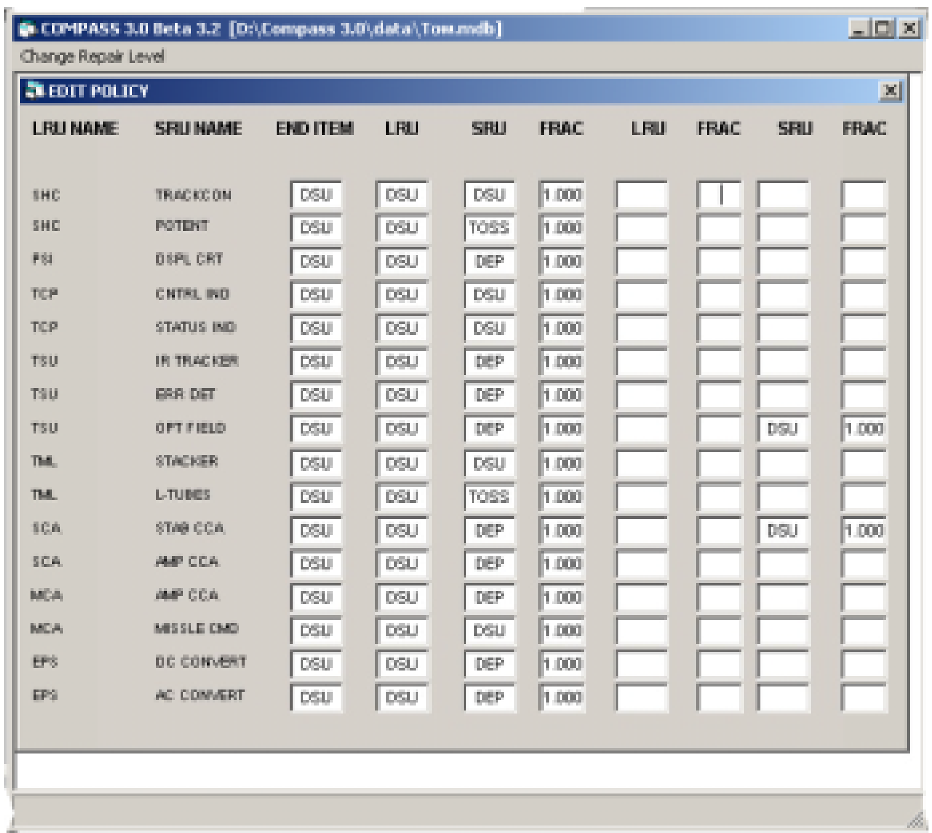


Figure 3-32

<**Policy File Edit**> is used to modify the maintenance concept that is generated after the Optimizer is executed. The maintenance concept is stored in a file with a [.POL] extension.

The purpose of modifying the policy file is to perform sensitivity analysis. One aspect of sensitivity analysis is observing the effect altering the maintenance concept will have on spares, manpower, and cost. In order to modify a policy file, the corresponding input file must be opened and the output file must first be generated. The Edit Policy File routine reads information from the output file when determining which maintenance levels are available for repair. The policy file is modified by using the Edit Policy File feature, but the Evaluator (not the Optimizer) must be executed to complete the procedure.

The policy file is generated by executing the Optimizer and is named using the input files name and the **"*.pol"** extension. Upon selecting <**Policy File Edit**>, COMPASS displays a screen similar to Figure 3-32. The appearance of the policy file will vary slightly depending on whether the run mode selected was Normal, Screening, or Multiple Repair. The example above depicts a run mode of Screening.

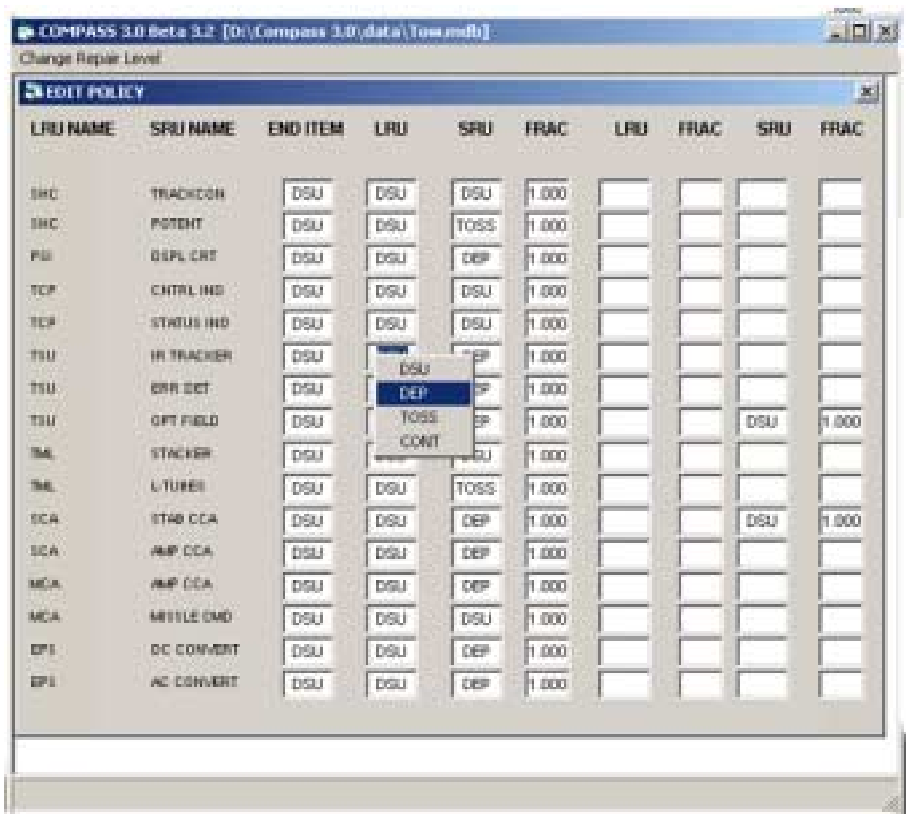


Figure 3-33

The policy file in Figure 3-33 lists the LRU name, SRU name, percent repair (titled "FRAC" in the heading), and repair echelon where the end item, LRUs, and SRUs are repaired. The user does not have the option to change the names of the LRUs and SRUs. Fields that may be modified are the repair levels for the end item, LRUs, and SRUs. To modify the maintenance level used in item repair, double-click the box that contains the maintenance level of the desired item. A pop-up screen will appear as depicted in Figure 3-33, listing the available levels of repair as well as the discard option "**TOSS**". Click on the desired maintenance level. This changes the maintenance concept to the level dictated by the user. To make a global change to the repair level for a particular indenture level of items (i.e. LRU), click on the <**Change Repair Level**> selection on the menu in the upper left corner. This action pops up the menu screen shown in Figure 3-34. Click on the desired item level and a pop-up box listing the choices appears.

Clicking on the desired repair level choice changes the repair for all the items in the column. When finished editing the policy file, click on form close icon (i.e. the "**x**" in the upper right corner) and the changes will be saved to the policy file. Run the evaluator to see the costs associated with the new policy file.

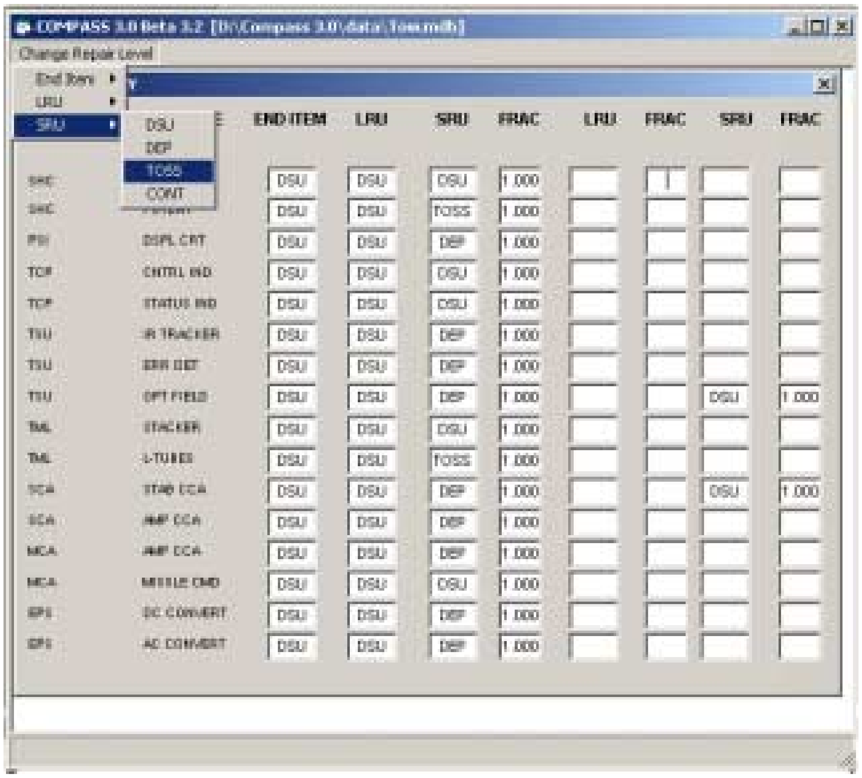


Figure 3-34

3.7 EXECUTE

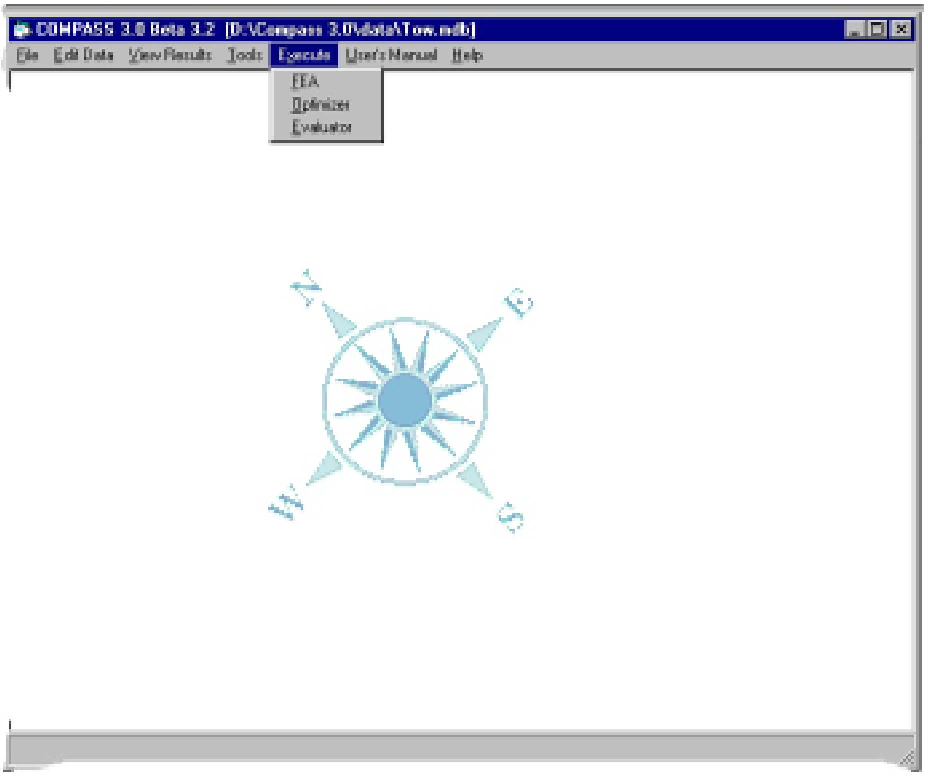


Figure 3-35

The <**Execute**> menu is used to generate COMPASS output files. It has three options: <**FEA**>, <**Optimizer**>, and <**Evaluator**>. After executing one of the options the <**View Results**> and <**Print**> (i.e. Located under the File Menu on the output screens), commands may be used to review the results of the run. Each of the three options depicted above is explained below.

The primary purpose of the Front-End Analysis program is to check the input file for errors and generate a report of the inputs. This program is automatically executed when the Optimizer or Evaluator is run. All input data errors must be corrected before the Optimizer and/or Evaluator will execute properly.

Selecting the Front-End Analysis option will execute the Front-End Analysis routine on the currently opened input file. The will be messages in the lower left corner of the COMPASS main screen that indicated that the routine is running. When the messages quit and the mouse cursor returns to normal, the routine is finished. The FEA output report will be named using the inputs file name with the extension "***.fea**". If errors are found then a box with the heading "Temp.ERR" will pop up with listing of those errors.

The Front-End Analysis report should be reviewed to determine if all data was input correctly.

To review the .FEA report, go to the “**View Results**” menu and select <**FEA**>. A copy of the report should be contained as an appendix to any LORA report that is compiled.

The Optimizer is executed to determine the least cost maintenance alternative for all items in the system based on user supplied input data. The results of this run serve as the baseline for which all future runs will be compared.

Selecting the <**Optimizer**> option will run the input file through the optimizer. Three files are generated in this process. They are the Front-End Analysis report, Optimization (system) report, and policy file. The system report contains a chart identifying optimal maintenance concept as well as stockage, manpower and support equipment requirements, and logistics support cost totals. The policy file is a file that only contains the maintenance concept for all items.

After the Optimizer has been run, the user may wish to determine the effect altering the maintenance concept will have on the overall logistics cost of the system. The user may also want to determine the effect that non-economic factors have on the overall life cycle cost. This type of analysis is accomplished by editing the policy file generated by the Optimizer run, and then executing the COMPASS Evaluator.

The <**Evaluator**> option computes logistics costs based upon the maintenance concept supplied by the user. The user defined maintenance concept is entered via editing the policy file. The Evaluator generates an output report identically formatted to that of the Optimizer. The only difference is the ***user supplies the maintenance concept*** when running the Evaluator. For this reason, the Optimizer must be executed first to generate a policy file. An attempt to execute the Evaluator before a policy file is generated will result in an error.

3.8 HELP & User Manual

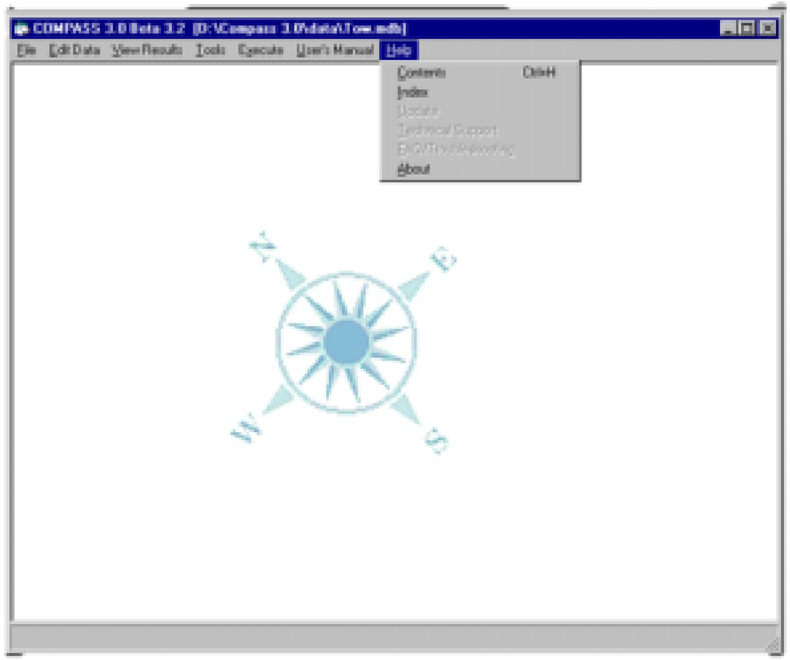


Figure 3-36

The online help shown above is accessed by clicking on <Help> on the menu bar. This action opens a drop down menu that lists the available selections. Clicking on <Contents> brings up the help system Table of Contents.

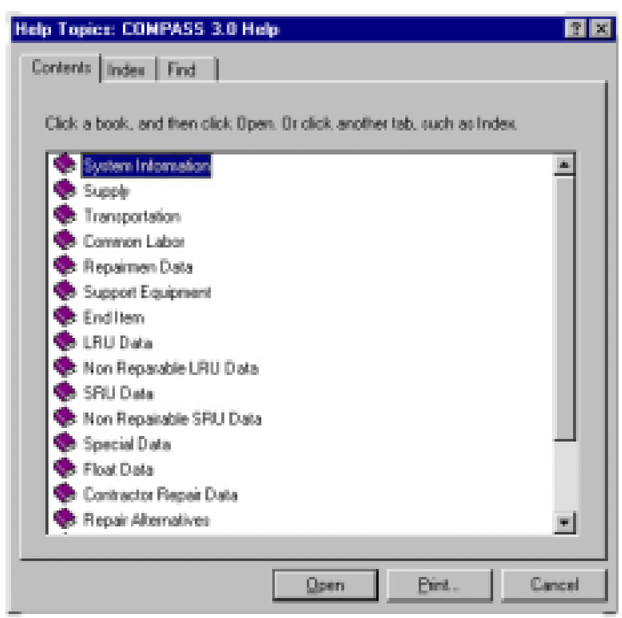


Figure 3-37

The Table of Contents breaks out the data elements by the category in which they appear. Click on the “Book” which then expands to shown the available listings. Click on a listing to display it.

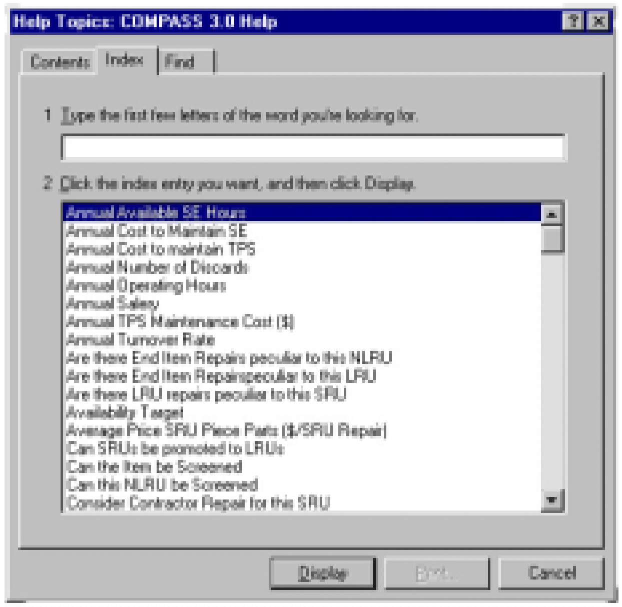


Figure 3-38

Clicking on <Index> brings up the index to the online help system as shown below. To find a topic, type the topic in box one and the help system will automatically scroll to the first reference (if any) in box 2. One can also scroll down the list in box 2 until the desired topic is found, highlight that topic by clicking on it, and then clicking on <**Display**>.

The online User’s Manual is accessed by clicking on <**User’s Manual**> from the menu bar. This action brings up the User’s Manual menu. The user’s manual works just like the online help described above.

OUTPUT PRODUCTS

COMPASS generates three output reports. The output reports are know as the Front End Analysis (FEA) report, the Optimizer Report, and the Evaluator Report. The following sections contain descriptions and examples of each report.

4.1 Front-End Analysis Report

The Front-End Analysis routine has three functions. The first function is to provide system level error checking that supplements the error checking done by the data input screens. The optimizer and evaluator will not execute if there are errors in the input file. The second function is to format the input data so that it can be feed to the Optimizer and Evaluator. The third function, discussed here, is to generate a summary report that contains the input data and some basic calculations. If the FEA routine has been successfully executed, the FEA report is accessed from the main menu bar by clicking on <View Results>-><View FEA>. The FEA report is displayed in grid format similar to MS Excel. The sections of the report are broken out in a tabbed format. To view a particular section of the report, click on the tab with the desired heading. An example of the output report generated is displayed below. All LORA reports should include a copy of the front-end analysis report.

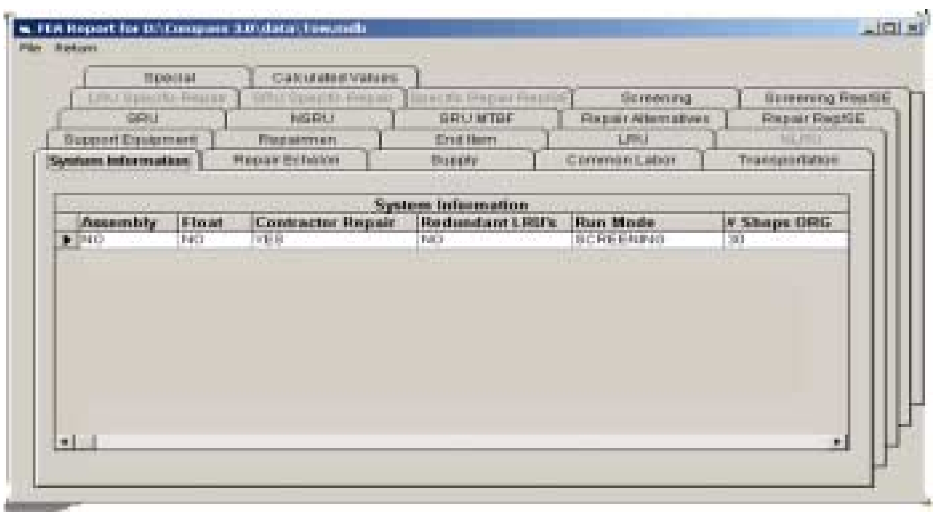


Figure 4-1

4.1.1 FEA Menu Bar

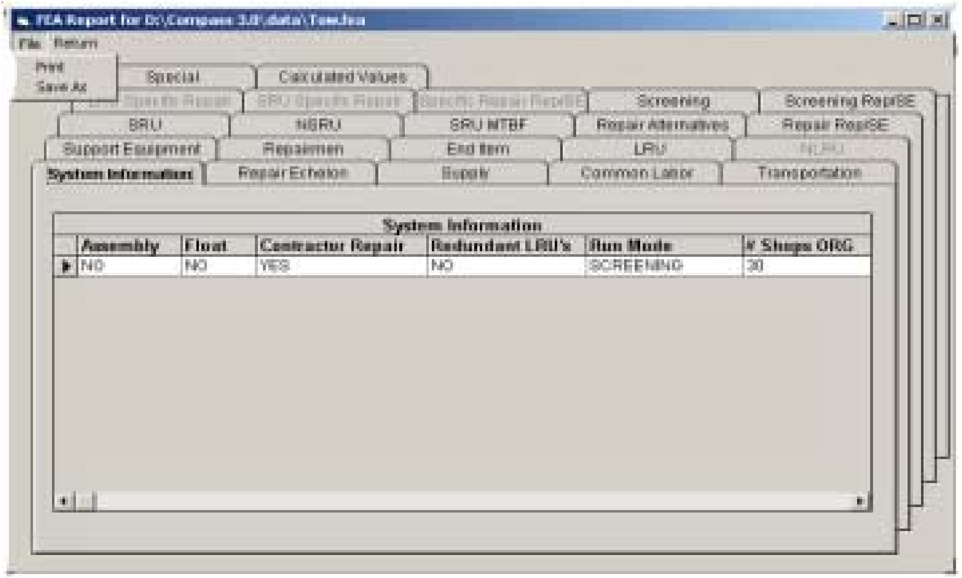


Figure 4-2

An example of the FEA output report is shown above. The file menu contains two selections <**File**> and <**Return**>. The <**File**> selection has two choices <**Print**> and <**Save As**>. The <Print> choice will send a formatted copy of the report to the computers default printer. The report is formatted in landscape mode and an example can be seen in Appendix C. The <**File**>-><**Save As**> allows for the current report to be saved under a different name. The <**Return**> selection will close the FEA report window.

4.1.2 System Information

The System Information section (shown in Fig's 4-1 and 4-2) contains most of the system information that was entered by the user in the System Information data entry screen. This section accessed by clicking of the System Information tab at the top of the screen. The information that is missing is the authorized repair and authorized screening echelons. The repair and screening echelons are placed in the Repair Echelon tab. The information is presented from left to right. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

4.1.3 Repair Echelon

The Repair Echelon tab (Figure 4-3) contains information pertaining to the echelons that are allowed to repair and/or screen the items under analysis. The information is presented from left to right. A "YES" notation indicates that the echelon is allowed to repair/screen the particular item. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

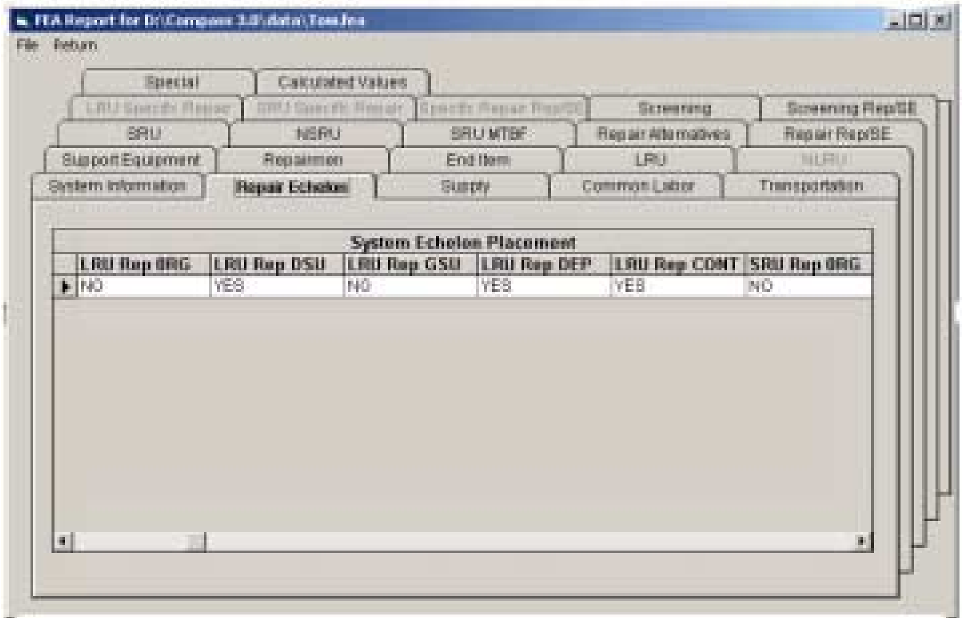


Figure 4-3

4.1.4 Supply

The Supply information is viewed by clicking on the Supply tab at the top of the FEA report. The scroll bar at the bottom of the screen is used to view the information that is not in the display. The Retail Stockage Criteria and the number of days of operating stock for each maintenance level is displayed in this screen. These values can be ignored if the file has been set to “Spare to Availability”.

4.1.5 Common Labor

The Common Labor information is viewed by clicking on the Common Labor tab at the top of the FEA report. The scroll bar at the bottom of the screen is used to view the information that is not in the display. Common Labor is used only on those items that do not have any support equipment and/or repairmen defined in the items repair alternative. In these instances, COMPASS will default to the Common Labor rates to generate a repair cost for the item.

4.1.6 Transportation

The Transportation information is viewed by clicking on the Transportation tab at the top of the FEA report. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

4.1.7 Support Equipment

The Support Equipment information (Figure 4-4) is viewed by clicking on the Support Equipment tab at the top of the FEA report. The scroll bar at the bottom of the screen is used to view the information that is not in the display. This screen features a split where the name of the Support Equipment is held in place while the user scrolls through the rest of the information.

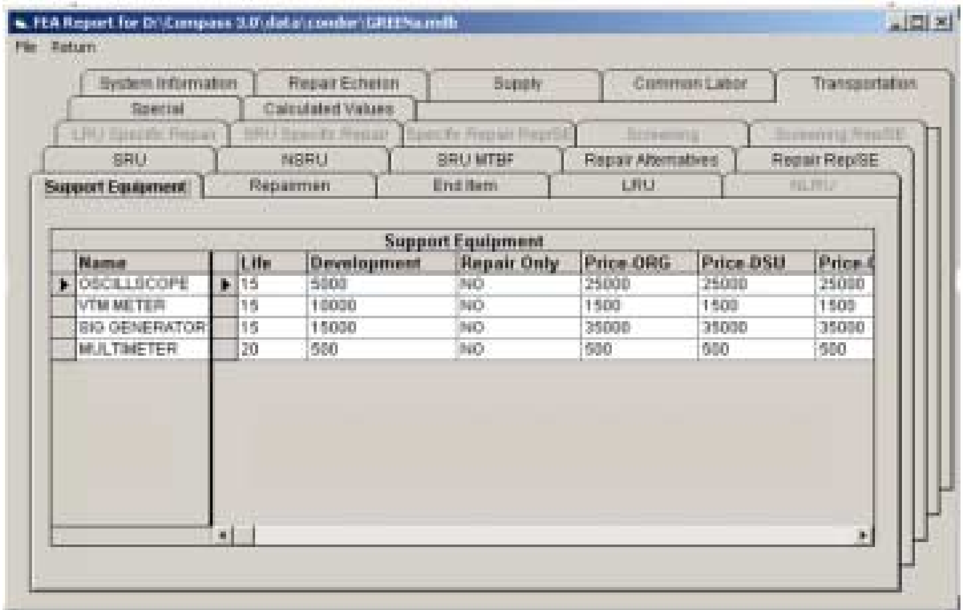
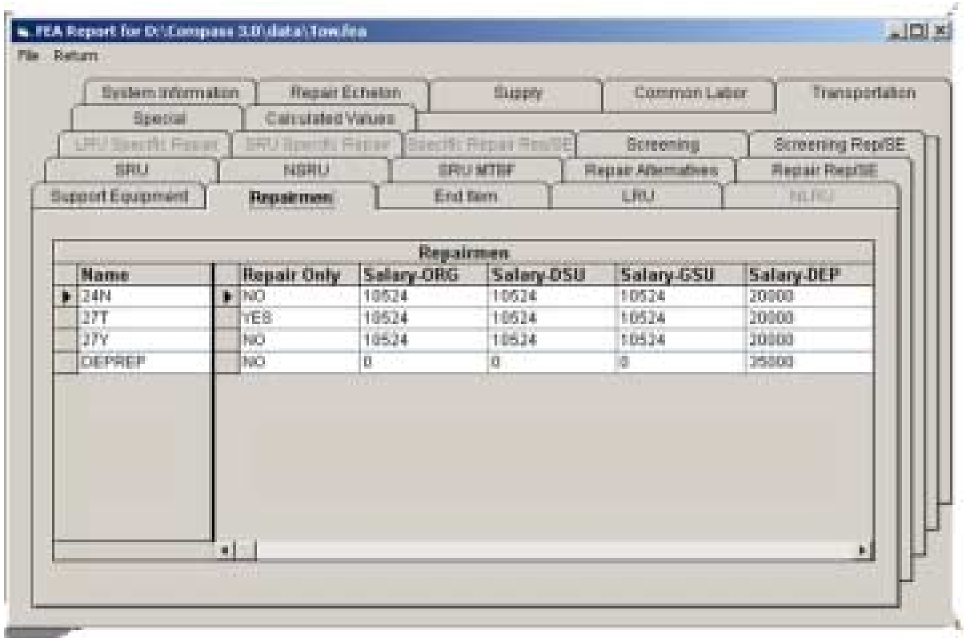


Figure 4-4

4.1.8 Repairmen

The Repairmen information (Figure 4-5) is viewed by clicking on the Repairmen tab at the top of the FEA report. The scroll bar at the bottom of the screen is used to view the information that is not in the display. This screen features a split where the name of the Repairmen is held in place while the user scrolls through the rest of the information.



Name	Repair Only	Salary-ORG	Salary-DSU	Salary-GSU	Salary-DEP
24N	NO	10524	10524	10524	20000
27T	YES	10524	10524	10524	20000
27Y	NO	10524	10524	10524	20000
DEPREP	NO	0	0	0	35000

Figure 4-5

4.1.9 End Item

The End Item information is viewed by clicking on the End Item tab at the top of the FEA report. The scroll bar at the bottom of the screen is used to view the information that is not in the display. Don't worry if the following fields are blank: "Cont Wor", "Cont Init Cost", "Cont Cost per Failure", "Cont Diagnostic cost", "Cont Response", "Ship to Cont", "Receive from Cont", "Float SOST", "Float Install Time", "Float Issue", and "Float Repair". These fields refer to optional data. A blank field indicates that the option to enter data into these fields was never selected.

4.1.10 LRU

The LRU information (Figure 4-6) is viewed by clicking on the LRU tab at the top of the FEA report. The scroll bar at the bottom of the screen is used to view the information that is not in the display. The following fields may be blank: "Cont Wor", "Cont Init Cost", "Cont Cost per Failure", "Cont Diagnostic cost", "Cont Response", "Ship to Cont", and "Receive from Cont". These fields refer to optional data. A blank field indicates that the option to enter data into these fields was never selected.

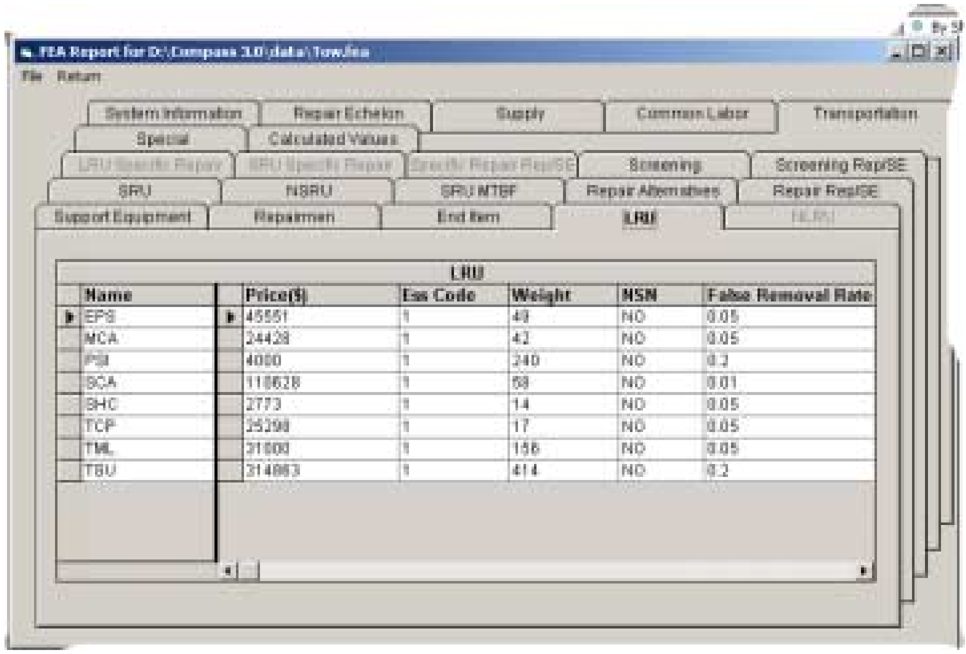


Figure 4-6

4.1.11 NLRU

The NLRU information is viewed by clicking on the NLRU tab at the top of the FEA report. The scroll bar at the bottom of the screen is used to view the information that is not in the display. The NLRU tab may be "grayed out" and thus inaccessible. This happens if no NLRUs were input.

4.1.12 SRU

The SRU information (Figure 4-7) is viewed by clicking on the SRU tab at the top of the FEA report. The scroll bar at the bottom of the screen is used to view the information that is not in the display. The following fields may be blank: "Cont Wor", "Cont Init Cost", "Cont Cost per Failure", "Cont Diagnostic cost", "Cont Response", "Ship to Cont", and "Receive from Cont". These fields refer to optional data. A blank field indicates that the option to enter data into these fields was never selected.

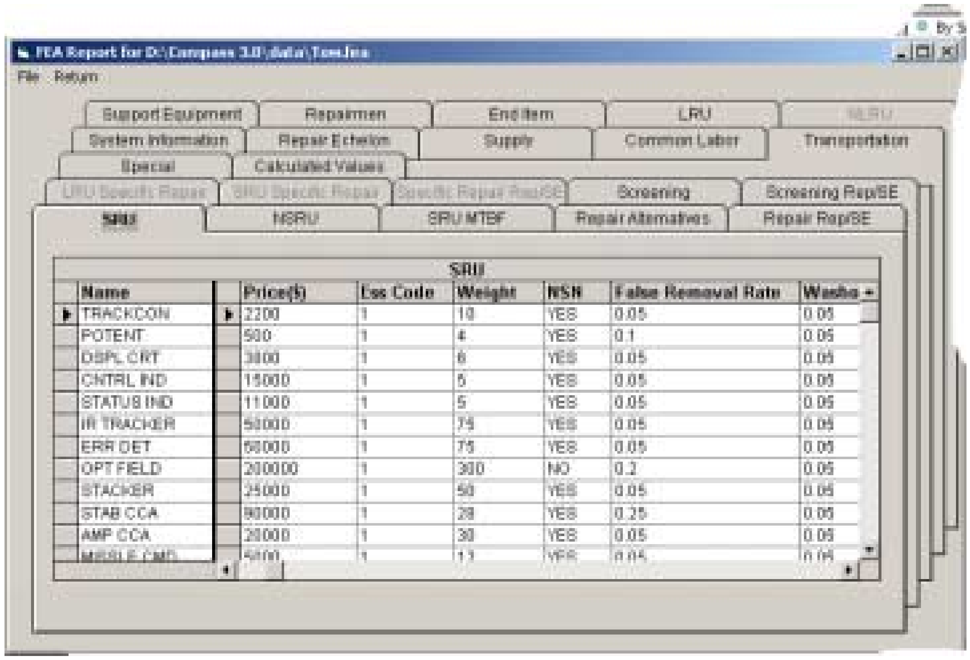


Figure 4-7

4.1.13 NSRU

The NSRU information is viewed by clicking on the NLRU tab at the top of the FEA report. The scroll bar at the bottom of the screen is used to view the information that is not in the display. The NSRU tab may be “grayed out” and thus inaccessible. This happens if no NSRUs were input.

4.1.14 SRU MTBF

The SRU MTBF (Figure 4-8) information is viewed by clicking on the SRU MTBF tab at the top of the FEA report. This screen displays the MTBF of each SRU and the SRU’s corresponding LRU. SRUs are allowed to be in more than one LRU. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

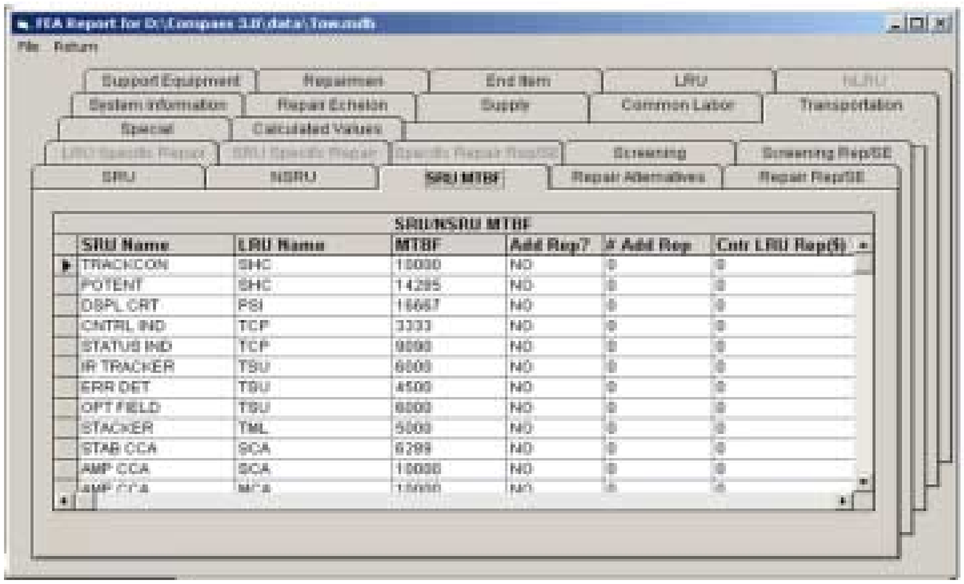


Figure 4-8

4.1.15 Repair Alternatives

The Repair Alternatives (Figure 4-9) information is viewed by clicking on the Repair Alternatives tab at the top of the FEA report. This screen displays each repair alternative for an item. Repair alternatives are denoted as “alt1”, “alt2” or “alt3”. The number of possible repair alternatives for each item is dependent on both the run mode and the number of alternatives input. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

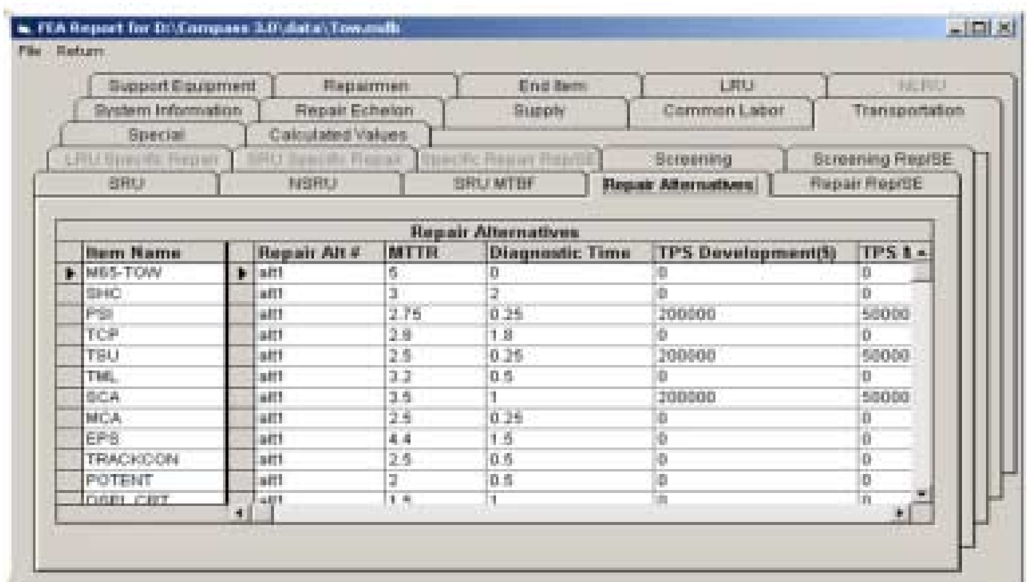


Figure 4-9

4.1.16 Repair Rep/SE

The Repair Rep/SE (Figure 4-10) information is viewed by clicking on the Repair Rep/SE tab at the top of the FEA report. This screen displays the repairmen, support equipment and time each is used to repair an item in each defined repair alternative. As with the Repair Alternatives tab, the number of possible repair alternatives for each item is dependent on both the run mode and the number of alternatives input. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

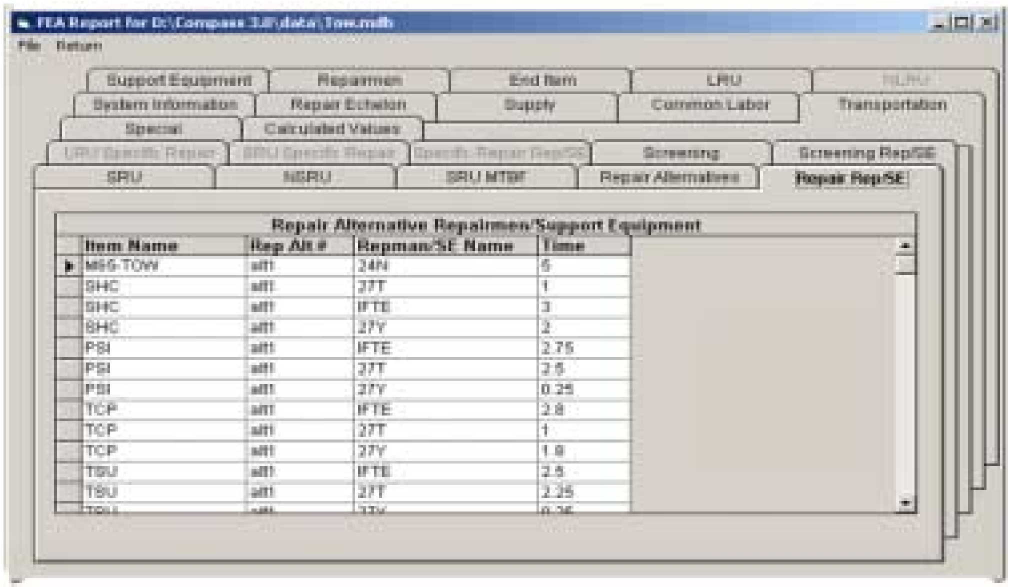


Figure 4-10

4.1.17 LRU Specific Repair

The LRU Specific Repair information is viewed by clicking on the LRU Specific Repair tab at the top of the FEA report. This screen is activated (the default is for the tab to be "grayed out") whenever an LRU is marked to generate a specific end item repair whenever the LRU fails. A specific end item repair is a repair that is not normally part of the standard repair alternative. An example would be that the failure of a certain LRU would cause the end item to be recalibrated before the end item is returned to service. The information displayed is the name of the LRU, the associated repair alternative number and the MTTR for the end item repair including the "specific repair". The scroll bar at the bottom of the screen is used to view the information that is not in the display.

4.1.18 SRU Specific Repair

The SRU Specific Repair information is viewed by clicking on the SRU Specific Repair tab at the top of the FEA report. This screen is activated (the default is for the tab to be "grayed out") whenever an SRU is marked to generate a specific LRU repair whenever the SRU fails. A specific LRU repair is a repair that is not normally part of the standard repair alternative. An example would be that the failure of a certain SRU would cause the LRU to be recalibrated before the end item is returned to service. The information displayed is the name of the SRU, the name of the LRU, the associated repair alternative number, the MTTR for the LRU repair including the "specific repair", and the number of pages of documentation that would be saved if the SRU were discard instead of repaired. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

4.1.19 Specific Repair Rep/SE

The Specific Repair Rep/SE information is viewed by clicking on the Specific Repair Rep/SE tab at the top of the FEA report. This screen displays the repairmen, support equipment and time each is used to repair an item for each defined specific repair alternative. This tab is normally "grayed out". This tab is only accessible whenever specific repair information has been entered for an LRU or an SRU. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

4.1.20 Screening

The Screening information (Figure 4-11) is viewed by clicking on the Screening tab at the top of the FEA report. This screen displays the information on those items that have been designated as candidates for screening. The run mode has to be set to allow screening before the tab is rendered accessible. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

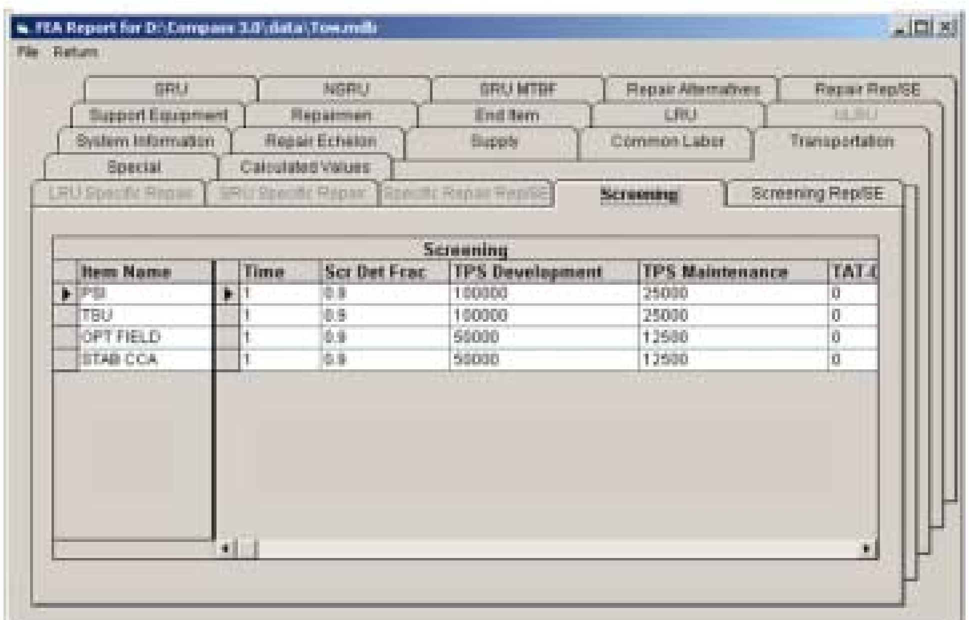


Figure 4-11

4.1.21 Screening Rep/SE

The Screening Rep/SE information is viewed by clicking on the Screening Rep/SE tab at the top of the FEA report. This screen displays the repairmen, support equipment and time each is used to screen an item. This tab is accessible only if the run mode was set to “Screening”. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

4.1.22 Special

The Special information is viewed by clicking on the Special tab at the top of the FEA report. This screen displays the information that didn’t really fit anywhere else and is lumped under the “Special” input screen. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

4.1.23 Calculated Values

The Calculated Values are viewed by clicking on the Calculated Values tab at the top of the FEA report. The costs displayed in this tab are those recurring costs that have been brought back into terms of present day dollars by using the Present Value Factor. The Present Value Factor is based upon the input discount rate and the life span of the end item. Also included in this section is the Derived Mean Time Between Failure for the End Item, the calculated inherent availability, and the calculated number of End Item failures per year.

4.2 Optimizer Report

The primary purpose of the optimizer routine is to determine the optimum (least cost) maintenance concept. The optimizer report generated by the optimizer routine provides the least cost maintenance concept for each item identified in the input file. The optimizer report also computes life cycle maintenance and support costs associated with the maintenance concept. Included among the maintenance and support costs are the quantities and locations of the initial spares for the repairable items in the input file. Once the optimizer routine has been successfully executed, the optimizer report is viewed by clicking on <View Results>-><Optimizer> from the main menu bar. The Optimizer report is displayed in grid format similar to MS Excel. The sections of the report are broken out in a tabbed format. To view a particular section of the report, click on the tab with the desired heading. An example of the output report generated is displayed below.

4.2.1 Maintenance Policy

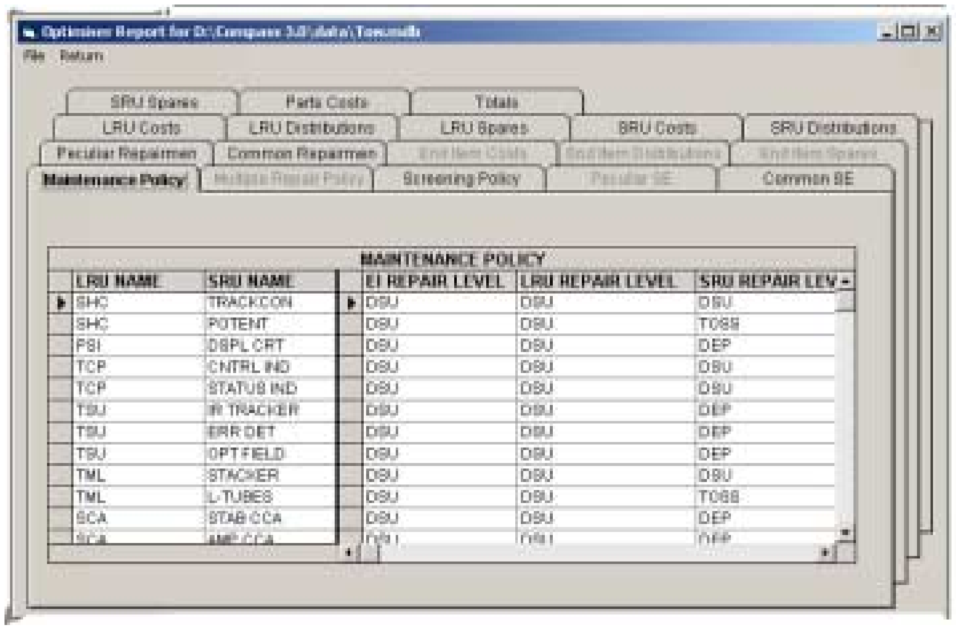


Figure 4-12

The Maintenance Policy information is viewed by clicking on the Maintenance Policy tab. This section shown in Figure 4-12 is the primary output of COMPASS. The maintenance policy indicates if and where each part of the system is to be replaced, repaired, or discarded. The End Item (EI) Repair Level, Line Replaceable Unit (LRU) Repair Level and Shop Replaceable Unit (SRU) Repair Level columns indicate where repair will be performed for the LRU / SRU combination identified in each row. The maintenance policy also indicates if a part should be discarded (TOSS). For example, consider LRU SHC. Failure of LRU SHC will result due to a failure of either SRU TRACKCON or SRU POTENT. In either case, the END ITEM will also fail. When the END ITEM fails due to a failure of LRU SHC, the END ITEM will be repaired at DSU by remove and replace of LRU SHC. LRU SHC will be repaired at the DSU by remove and replace of either SRU TRACKCON or SRU POTENT (determined by which SRU failed). If SRU TRACKCON caused the failure, it is repaired at the DSU by remove and replace of piece parts. If SRU POTENT caused the failure, it is not repaired, which is indicated by TOSS in the SRU column. The analyst should note that the FRACTION OF TIME for each application is 1.00, or 100% of the time. If the model recommends a split maintenance concept, the LRU / SRU combination will be listed twice and the percentage of time for each application will be indicated under FRACTION OF TIME. If an asterisk is present in the SRU PROMOTED column, then the SRU has a low washout rate and the model will treat the SRU as an LRU for stockage purposes. If an asterisk or letter is present in the SENSITIVITY FLAG column, the model is close to recommending a different maintenance concept. Sensitivity analysis should then be performed to determine the changes necessary to force the model toward a different concept. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

4.2.2 Multiple Repair Policy

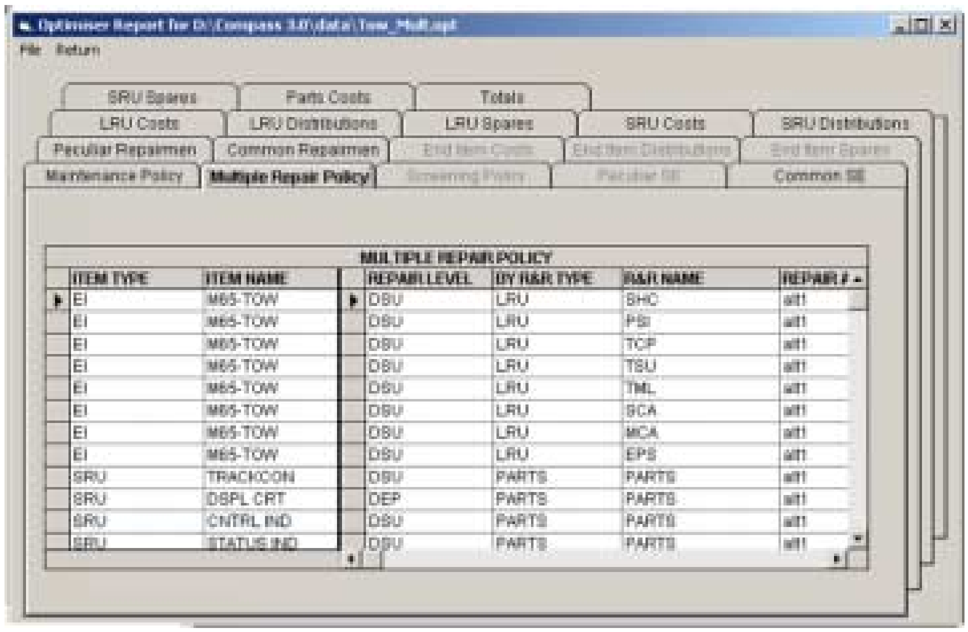


Figure 4-13

The Multiple Repair Policy information is viewed by clicking on the Multiple Repair Policy tab. This tab is only accessible whenever an optimizer output report is generated and the run mode on the <System Information> screen is set to "**Multiple Repair**". Otherwise the tab is not accessible and the tab title "grayed out".

An example of the multiple repair policy output is shown in Figure 4-13. The grid identifies where the item should be: repaired (Repair Level), how the item is repaired (removing and replacing a lower level indenture item), and the name of the repair alternative selected. The **FRACTION OF TIME** column identifies the percentage of time this maintenance policy should be applied. The presence of a letter or asterisk in the **SENSITIVITY FLAG** column indicates that the model is very close to selecting a different repair policy for the application. Sensitivity analysis should then be performed to determine the changes necessary to force the model toward a different concept.

The ordering of the multiple repair output tends to be confusing when compared to the outputs displayed on the Maintenance Policy tab or the Screening tab. The End Item (EI) repairs are shown first followed by the SRU repairs and then getting to the LRU repairs. The other policy tabs order the output EI, LRU and then SRU. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

4.2.3 Screening Policy

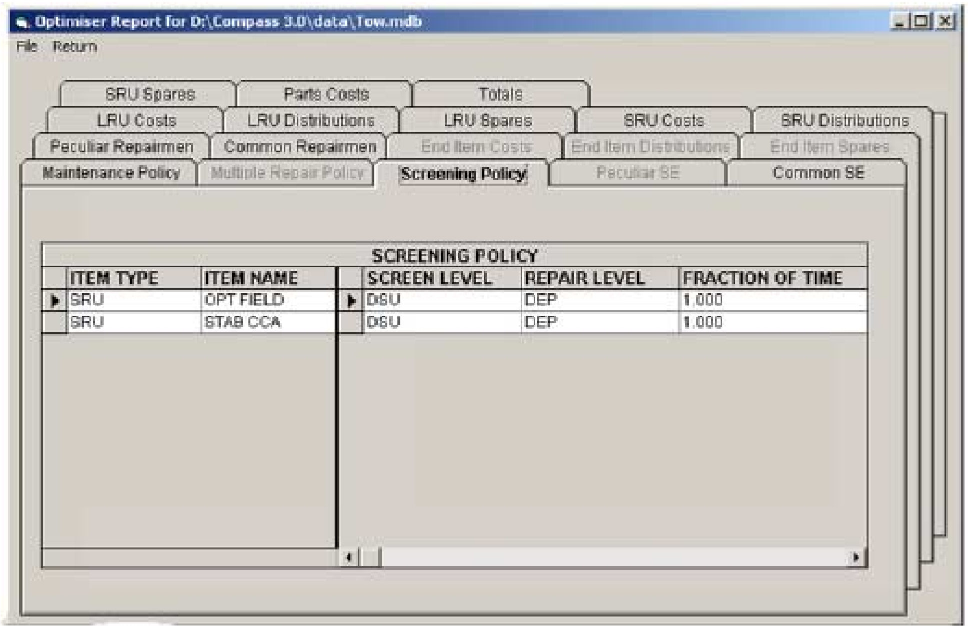


Figure 4-14

The **Screening Policy** (shown in Figure 4-14) information is viewed by clicking on the Screening Policy tab. This tab is only accessible whenever an optimizer output report is generated and the run mode on the <System Information> screen is set to "**Screening**". Otherwise the tab is not accessible and the tab title "grayed out".

This section identifies items that will benefit from screening from a purely economic standpoint. The model compares the cost of screening the item before repair versus just repairing the item. COMPASS lists these items along with the maintenance echelons where the screening action and repair should occur. COMPASS will not allow screening to occur at the same echelon where the item is repaired. For this reason, the maintenance echelons will always vary between the SCREENED AT and REPAIRED AT columns. The FRACTION OF TIME column identifies what fraction of time this maintenance policy should be applied. The sum of the FRACTION OF TIME for each item must be one. In this example, two each of the LRUs and SRUs were identified as candidates for screening in the input file. However, only the SRUs were selected for screening. The absence of the LRUs from the list indicates that screening is not economically justifiable.

The presence of a letter or asterisk in the SENSITIVITY FLAG column indicates that the model is very close to selecting a different repair policy for the application. Sensitivity analysis should then be performed to determine the changes necessary to force the model toward a different concept.

Three additional columns appear after FRACTION OF TIME. The columns are: "**Labor**", "**Savings**", and "**Include Screen TPS"**. The scroll bar at the bottom of the screen is used to view these columns. The only time costs will appear in these columns is if there were no screening support equipment or repairmen identified on the Screening Alternative data input screen. The labor cost for screening will be calculated using the common labor costs with the results displayed in the "**Labor**" column and the cost savings appearing in the "**Savings**" Column.

4.2.4 Peculiar SE

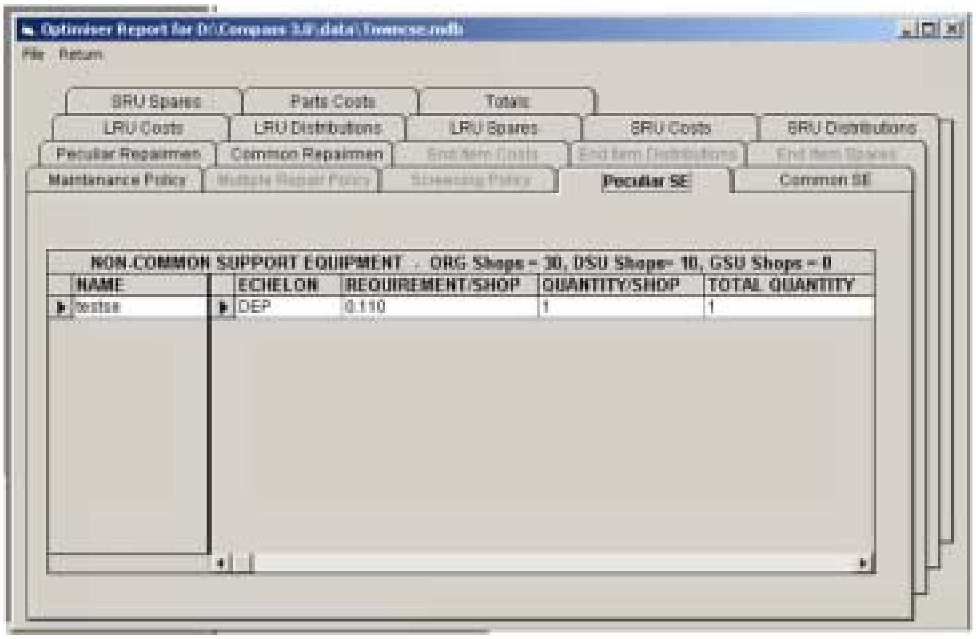


Figure 4-15

The Peculiar Support Equipment (SE) (shown in Figure 4-15) information is viewed by clicking on the Peculiar SE tab. This tab is only accessible when Peculiar or Non-Common SE outputs are generated. Otherwise, the tab is not accessible and the tab title is "grayed out". The scroll bar at the bottom of the screen is used to view the information that is not in the display.

In this example, there is only one peculiar SE, which is issued at the DEP. There is an 11% requirement for this SE at DEP (Remember COMPASS only considers one depot), or only 11% of this SE's available time is necessary to repair items of this system. The QUANTITY PER SHOP indicates, however, that each shop will be charged for one full SE. This is due to the SE being peculiar at the DEP. The TOTAL QUANTITY is the number of SE required at each shop multiplied by the number of shops. The total cost of the SE for the life of the end item is revealed in the TOTAL COST column. If support equipment has a development cost involved it will be shown in the DEVELOPMENT COST column. The ACCUMULATING QUANTITY is a running total of all the same SE needed across the different echelons. An example of the accumulating quantity is if there were 3 of the “testse” at the DSU and 2 at the DEP. The ACCUMULATING QUANTITY column for the “testse” listed at the DSU would be 3 while that of the DEP entry would be 5. The total cost of all peculiar support equipment over the life of the end item in present value is revealed in the **Totals** section.

4.2.5 Common SE

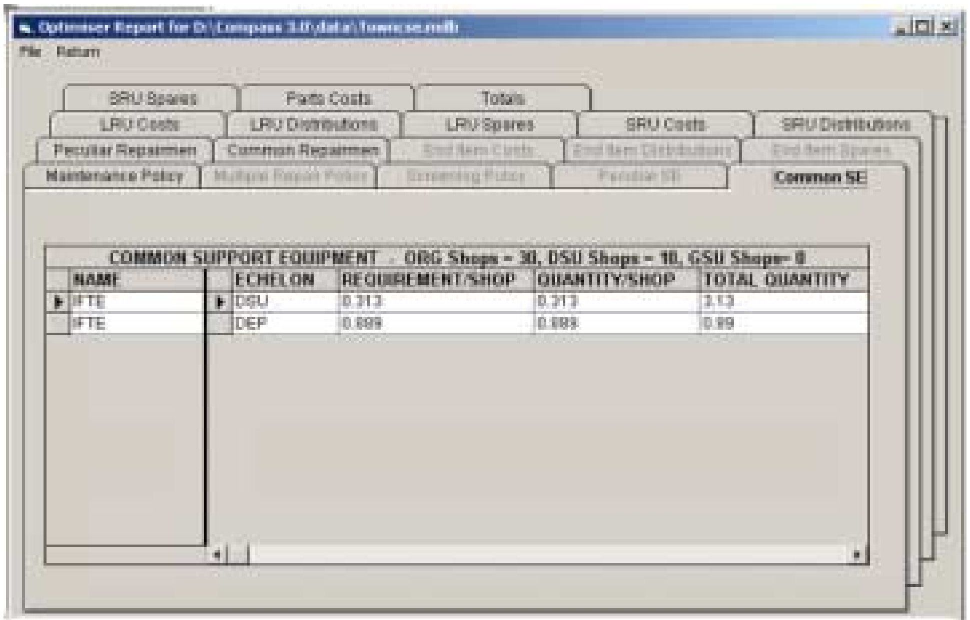


Figure 4-16

The Common Support Equipment (SE) (shown in Figure 4-16) information is viewed by clicking on the Common SE tab. This tab is only accessible when Common SE outputs are generated. Otherwise, the tab is not accessible and the tab title is “grayed out”. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

The Common SE display is similar to the Peculiar SE display. The difference is that the number in the QUANTITY/SHOP column is not rounded up to the nearest integer. In the example above, the requirement for IFTE at the DSU is 0.313, the QUANTITY/SHOP is 0.313 and the TOTAL QUANTITY is 3.13. This is interpreted as meaning that out of all 10 DSU shops that support the End Item, the usage rate of the IFTE is only enough to require 3.13 IFTE’s.

Note that the IFTE is also required to support Depot repairs. The requirement at DEP is .89, the QUANTITY/SHOP is .89 and the TOTAL QUANTITY at the DEP is .89. The ACCUMULATING QUANTITY is now 4.02.

4.2.6 Peculiar Repairmen

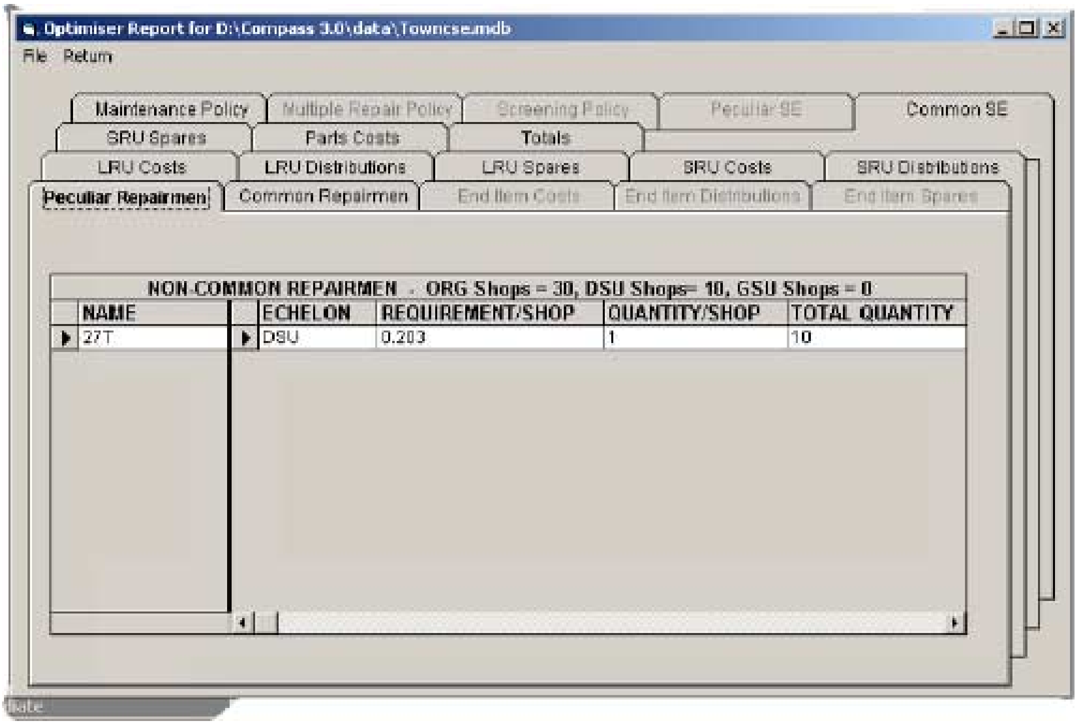


Figure 4- 17

The Peculiar Repairmen (shown in Figure 4-17) information is viewed by clicking on the Peculiar Repairmen tab. This tab is only accessible when Peculiar or Non-Common Repairmen outputs are generated. Otherwise the tab is not accessible and the tab title is “grayed out”. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

In the example above, there is only one peculiar repairman. The 27T repairman is located at the DSU. There is a 20.3% requirement for the 27T at the DSU, or only 20.3% of this SE’s available time is necessary to repair items of this system. The QUANTITY PER SHOP indicates, however, that each shop will be charged for one full SE. This is due to the SE being peculiar at the DSU. The TOTAL QUANTITY is the number of SE required at each shop multiplied by the number of shops. The total cost of the 27T for the life of the end item is $2,860,164.00 and is displayed in the TOTAL COST column. Training costs are included in the TOTAL COST Column. The ACCUMULATING QUANTITY is a running total of all the same SE needed across the different echelons. The total cost of all peculiar repairmen over the life of the end item in present value dollars is included in the **Totals** section.

4.2.7 Common Repairmen

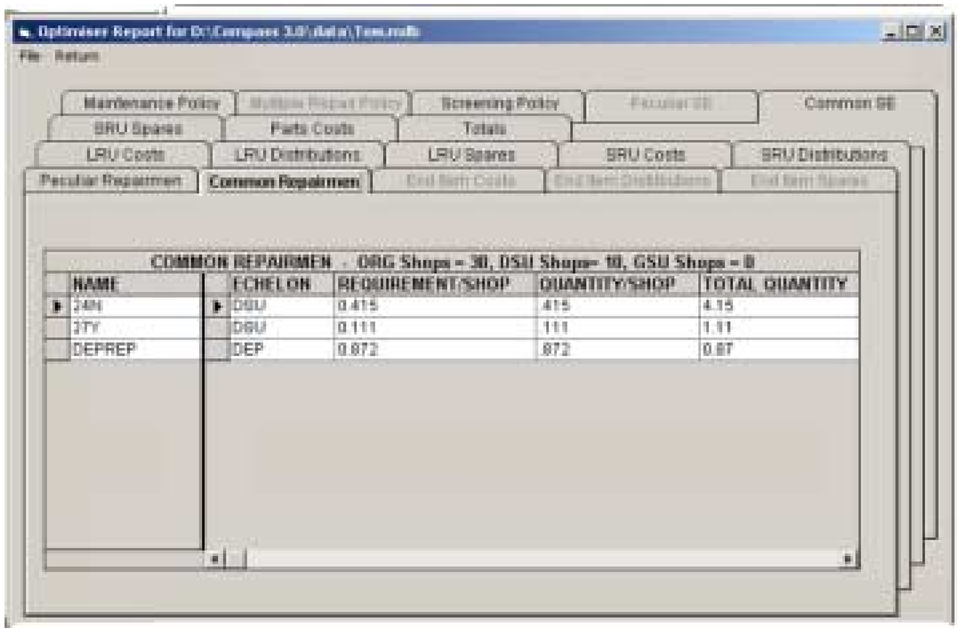


Figure 4-18

The Common Repairmen (shown in Figure 4-18) information is viewed by clicking on the Common Repairmen tab. This tab is only accessible when Common Repairmen outputs are generated. Otherwise the tab is not accessible and the tab title is "grayed out". The scroll bar at the bottom of the screen is used to view the information that is not in the display.

The Common Repairmen display is similar to the Peculiar Repairmen display. The difference is that the number in the QUANTITY/SHOP column is not rounded up to the nearest integer. In the example above, the requirement for the 24N at the DSU is 0.415, the QUANTITY/SHOP is 0.415 and the TOTAL QUANTITY is 4.15. This is interpreted as meaning that out of all 10 DSU shops that support the End Item, the usage rate of the 24N is only enough to require 4.15.

4.2.8 End Item Costs

The End Item Costs information is viewed by clicking on the End Item Costs tab. This tab is only accessible when End Item Cost outputs are generated. End Item Costs are generated under three conditions. The first two conditions are when the End Item is designated an assembly or end item floats are allowed. These two settings are set in the System Information data input screen. The third condition occurs whenever common labor is used in the repair of the end item as opposed to designating repairmen and support equipment to perform the repair. Otherwise the tab is not accessible and the tab title is "grayed out". The scroll bar at the bottom of the screen is used to view the information that is not in the display.

The costs displayed in this section are an itemization of the Logistics Costs for the End Item. The

INITIAL SPARES cost is the product of the unit price of the End Item and number of initial spares required to maintain the operational availability. The CONSUMPTION SPARES cost is directly attributed to washouts of the End Item. The CONSUMPTION SPARES cost represents units that must be purchased to replenish the supply. COMMON LABOR is zero if repairmen and/or support equipment have been designated to repair the End Item. If contractor repair is used the cost will appear in the CONTRACTOR column. TPS COST is the cost of any test program sets used in the repair action. The HOLDING, TRANSPORTATION, RECQUISITION, BIN, CATALOGING, and DOCUMENTATION costs are overhead type costs. The FIXED CONTRACTOR cost is not applicable to the end item. The CONTACT TEAM cost is for situations where a team is set out from the DSU to the End Item to repair the End Item. Note that depending on the condition that generated the End Item Costs, the individual costs can be zero or blank.

4.2.9 End Item Distributions

The End Item Distributions information is viewed by clicking on the End Item Distributions tab. This tab is only accessible when End Item Distributions outputs are generated. End Item Distributions are generated under two conditions. The conditions are when the End Item is designated an assembly or end item floats are allowed. These two settings are set in the System Information data input screen. Otherwise the tab is not accessible and the tab title is “grayed out”. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

The distributions referred to by the title are the Maintenance Task Distribution (MTD) and the Replacement Task Distribution (RTD). The Turn Around Time (TAT) for the End Item is also included in this section. The MTD portion reveals the percentage of time the End Item is repaired at an echelon. The RTD reveals where the End Item will be removed and replaced. Barring a split maintenance concept, the RTD will always indicate that remove and replace actions take place at the same echelon for a given item. The Turn Around Time for repair is the time the end item spends at the repair echelon and includes the time waiting for replacement LRU’s. The SESAME TAT is the TAT plus time for backorders of its LRUs. A significant discrepancy between these two TATs indicates a possible problem with backorders for that LRU.

4.2.10 End Item Spares

The End Item Spares information is viewed by clicking on the End Item Distributions tab. This tab is only accessible when End Item Spares outputs are generated. End Item Spares are generated under two conditions. The conditions are when the End Item is designated an assembly or end item floats are allowed. These two settings are set in the System Information data input screen. Otherwise, the tab is not accessible and the tab title is “grayed out”. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

The entry in each echelon column is the number of spares that must be stocked at every shop in the echelon to facilitate repair. To calculate the total number of spares at a maintenance echelon, multiply the entry in the column by the number of shops at the echelon. The heading QTY * UP is the initial spares cost and is equal to the total spares multiplied by the unit price of the end item. The last heading shows the calculated number of yearly failures the end item. This is calculated by using the MTBF of the end item and the Annual Operating Hours of the end item.

4.2.11 LRU Costs

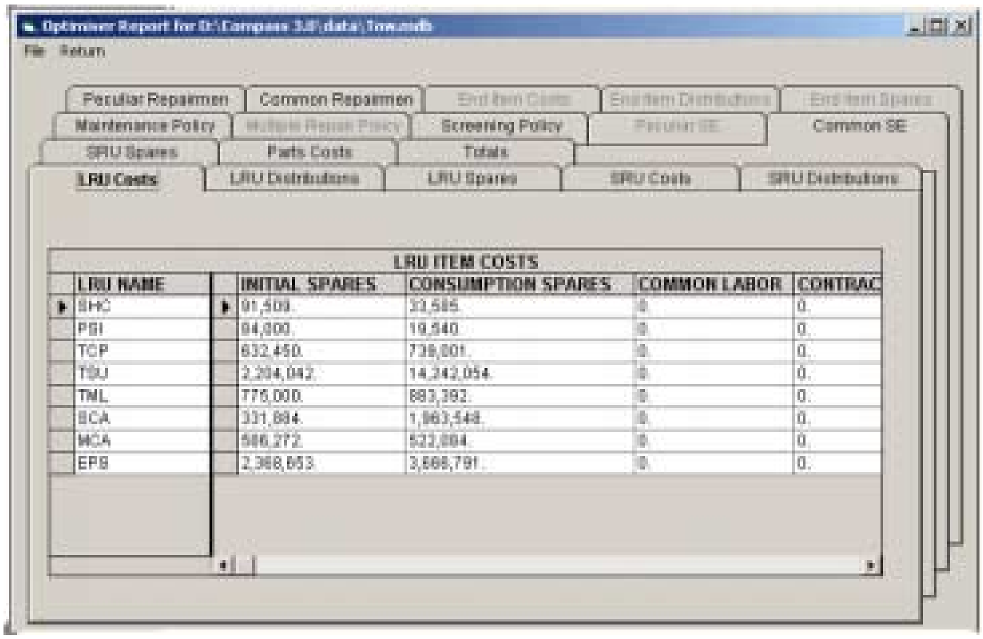
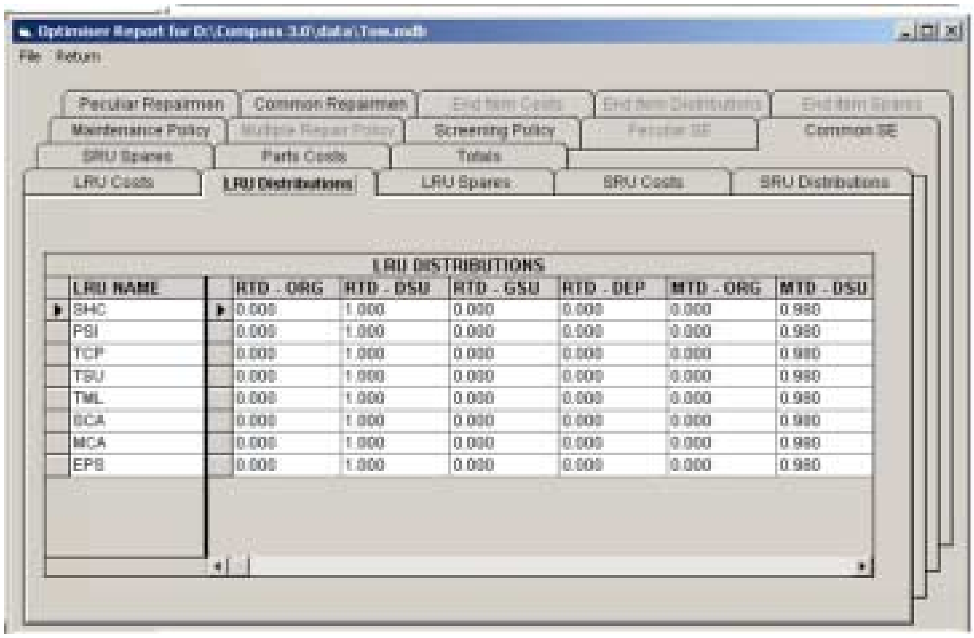


Figure 4-19

The LRU Costs information is viewed by clicking on the LRU Costs tab. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

The costs displayed (shown in Figure 4-19) are an itemization of the Logistics Costs for the LRU. The INITIAL SPARES cost is the product of the unit price of the LRU and number of initial spares required to maintain the operational availability. The CONSUMPTION SPARES cost is directly attributed to washouts of the LRU. The CONSUMPTION SPARES cost also represents units that must be purchased to replenish the supply. COMMON LABOR is zero if repairmen and/or support equipment have been designated to repair the LRU. If contractor repair is used the cost will appear in the CONTRACTOR column. TPS COST is the cost of any test program sets used in the repair action. The HOLDING, TRANSPORTATION, RECQUISITION, BIN, CATALOGING, and DOCUMENTATION costs are overhead type costs. The FIXED CONTRACTOR cost is not applicable to the LRU. The CONTACT TEAM is not applicable to the LRU.

4.2.12 LRU Distributions



LRU NAME	RTD - ORG	RTD - DSU	RTD - GSU	RTD - DEP	MTD - ORG	MTD - DSU
SHC	0.000	1.000	0.000	0.000	0.000	0.980
PSI	0.000	1.000	0.000	0.000	0.000	0.980
TCP	0.000	1.000	0.000	0.000	0.000	0.980
TSU	0.000	1.000	0.000	0.000	0.000	0.980
TML	0.000	1.000	0.000	0.000	0.000	0.980
SCA	0.000	1.000	0.000	0.000	0.000	0.980
MCA	0.000	1.000	0.000	0.000	0.000	0.980
EPS	0.000	1.000	0.000	0.000	0.000	0.980

Figure 4-20

The LRU Distribution information is viewed by clicking on the LRU Distribution tab. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

The distributions are the Maintenance Task Distribution (MTD), Replacement Task Distribution (RTD), and Turn Around Time for the LRUs. The MTD portion reveals the percentage of time the LRU is repaired at an echelon. The RTD reveals where the LRU will be removed and replaced. Barring a split maintenance concept, the RTD will always indicate that remove and replace actions take place at the same echelon for a given item. The Turn Around Time for repair is the time the LRU spends at the repair echelon and includes the time waiting for replacement SRUs. The SESAME TAT is the TAT plus time for backorders of its SRUs. A significant discrepancy between these two TATs indicates a possible problem with backorders for that LRU.

4.2.13 LRU Spares

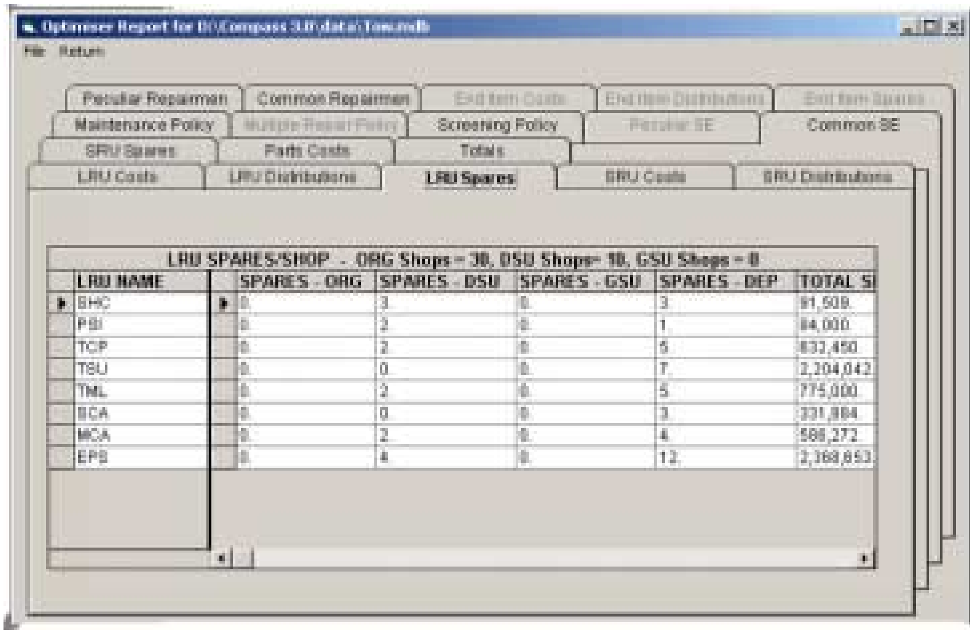


Figure 4-21

The LRU Spares information is viewed by clicking on the LRU Spares tab. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

The LRU Spares display (Figure 4-21) indicates the spares requirement for the LRUs that must be met to maintain the target availability. The entry in each echelon column is the number of spares that must be stocked at every shop in the echelon to facilitate repair. To calculate the total number of spares at a maintenance echelon, multiply the entry in the column by the number of shops at the echelon. For example, consider LRU SHC in the above chart. To maintain the target availability, 2 spares must be stocked at each DSU shop and 3 spares must be stocked at the Depot. There are 10 DSU shops; so 20 spares will be needed at the DSU level. Add in the 3 spares required at the Depot, and the total number of spares of LRU SHC equals 23. The heading QTY * UP is the initial spares cost and is equal to the total spares multiplied by the unit price of the LRU. The next to last heading shows the calculated number of yearly failures of each LRU for one end item. The last column shows the calculated MTBF of the LRU. This is calculated by using the number of failures per year (previous column) of the LRU and the Annual Operating Hours of the end item.

4.2.14 SRU Costs

The SRU Costs information is viewed by clicking on the SRU Costs tab. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

The costs displayed in this section are an itemization of the Logistics Costs for the SRU. The

INITIAL SPARES cost is the product of the unit price of the SRU and number of initial spares required to maintain the operational availability. The CONSUMPTION SPARES cost is directly attributed to washouts of the SRU. The CONSUMPTION SPARES cost also represents units that must be purchased to replenish the supply. COMMON LABOR is zero if repairmen and/or support equipment have been designated to repair the SRU. If contractor repair is used the cost will appear in the CONTRACTOR column. TPS COST is the cost of any test program sets used in the repair action. The HOLDING, TRANSPORTATION, RECQUISITION, BIN, CATALOGING, and DOCUMENTATION costs are overhead type costs. The FIXED CONTRACTOR cost appears if the question "Will Contractors receive an equal proportion of failures" that appears on the "Special Data" input screen is set to "NO" and the additional contractor input for the SRU has been entered. The CONTACT TEAM is not applicable to the LRU.

4.2.15 SRU Distributions

The SRU Distribution information is viewed by clicking on the SRU Distribution tab. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

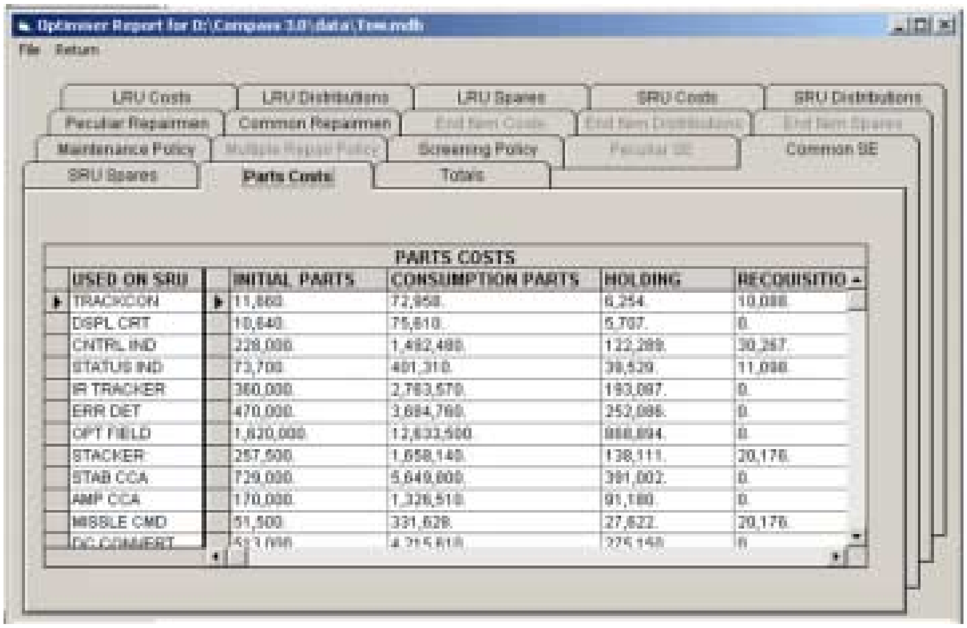
The distributions are the Maintenance Task Distribution (MTD), Replacement Task Distribution (RTD), and Turn Around Time for the SRUs. The MTD portion reveals the percentage of time the LRU is repaired at an echelon. The RTD reveals where the LRU will be removed and replaced. Barring a split maintenance concept, the RTD will always indicate that remove and replace actions take place at the same echelon for a given item. The Turn Around Time for repair is the time the LRU spends at the repair echelon and includes the time waiting for replacement parts. The SESAME TAT is the TAT plus time for backorders of its parts. A significant discrepancy between these two TATs indicates a possible problem with backorders for that SRU.

4.2.16 SRU Spares

The SRU Spares information is viewed by clicking on the SRU Spares tab. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

The SRU Spares display (Figure 4-21) indicates the spares requirement for the SRUs that must be met to maintain the target availability. The entry in each echelon column is the number of spares that must be stocked at every shop in the echelon to facilitate repair. The heading QTY * UP is the initial spares cost and is equal to the total spares multiplied by the unit price of the SRU. The last heading shows the calculated number of yearly failures of each SRU for one end item. This is calculated by using the MTBF of the SRU and the Annual Operating Hours of the end item.

4.2.17 Parts Costs



USED ON SRU	INITIAL PARTS	CONSUMPTION PARTS	HOLDING	RECQUISITIO
TRACKCON	11,860.	72,958.	6,254.	10,088.
DSPL CRT	10,640.	75,610.	5,707.	0.
CNTRL IND	228,000.	1,492,480.	122,289.	30,267.
STATUS IND	73,700.	401,310.	39,529.	11,098.
IR TRACKER	360,000.	2,763,570.	193,087.	0.
ERR DET	470,000.	3,684,760.	252,086.	0.
OPT FIELD	1,620,000.	12,633,500.	868,894.	0.
STACKER	257,500.	1,658,140.	138,111.	20,176.
STAB CCA	729,000.	5,649,800.	391,002.	0.
AMP CCA	170,000.	1,326,510.	91,180.	0.
MISSLE CMD	51,500.	331,628.	27,622.	20,176.
DC CONVERT	513,000.	4,215,610.	275,150.	0.

Figure 4-22

The Parts Cost information is viewed by clicking on the Parts Cost tab. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

The Parts Costs display details the logistics costs of the piece parts used in the SRUs that are repaired.

4.2.18 Totals

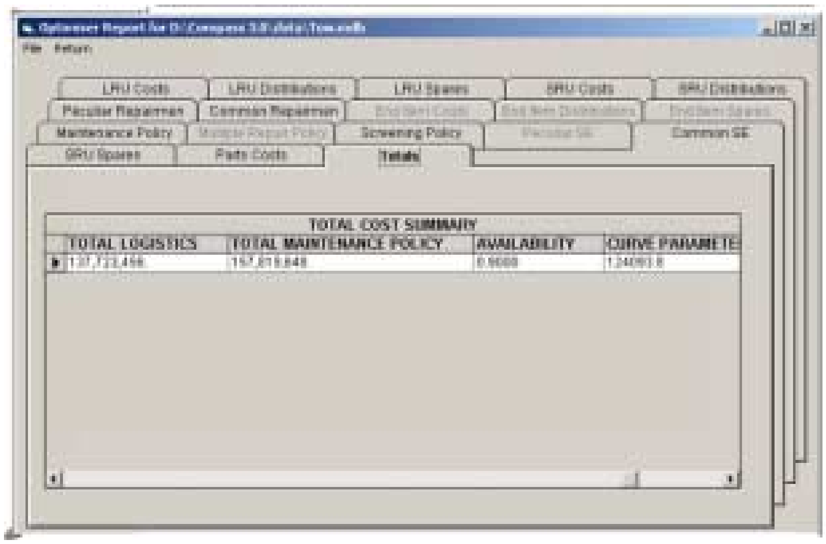


Figure 4-23

The Totals information (Figure 4-23) is viewed by clicking on the Totals tab. The scroll bar at the bottom of the screen is used to view the information that is not in the display.

The costs displayed above are totals from the support equipment, repairmen, and the logistics costs for all of the items. The “TOTAL LOGISTICS” cost is the summation of the logistics costs for the items. The “TOTAL MAINTENANCE POLICY” is the sum of the “TOTAL LOGISTICS” cost plus the “TOTAL REPAIRMEN” plus the “TOTAL SE”. Also included in this section is the “AVAILABILITY” result. The “AVAILABILITY” is the operational availability that the model obtained that is closet to the target availability. The “CURVE PARAMETER” is an internally computer value related to the cost of the stockage required to meet the availability target. The Curve Parameter as it is used in COMPASS isn’t meaningful to most analysts. For a detailed discussion of the parameter, consult the SESAME user’s guide.

4.3 Evaluator Report

Output generated from executing the evaluator is identical to output generated by executing the optimizer. The difference between the two is that the optimizer generates the maintenance policy while the evaluator looks at changes made to the maintenance policy (through the use of the policy file editor) and/or the input file. It is important to remember that the evaluator cannot be executed until a policy has been generated (which only occurs through execution of the optimizer). If the policy file is changed through the use of the policy file editor, it is important that the Evaluator be run instead of the Optimizer. Running the Optimizer will erase all changes made to the policy file and defeat the purpose of the policy file editor.

Once the Evaluator routine has been successfully executed, the report is viewed by clicking on <View Results>-><Evaluator> from the main menu bar. The Evaluator report is displayed in grid format similar to MS Excel. The sections of the report are broken out in a tabbed format. To view a particular section of the report, click on the tab with the desired heading.

MODELING IN COMPASS

The purpose of this section is to provide the user with information required to model a system in COMPASS. It is divided into three subsections. The first three sections explain the basic modeling technique used in COMPASS. The basic modeling technique includes breaking down a system into the required three level indenture structure, key inputs that dictate what additional inputs are required, and sensitivity analysis. The last section describes advanced modeling techniques using COMPASS.

5.1 Equipment Breakdown

A key element in constructing an input data file is the ability to properly identify the breakdown of the weapon system consistent with COMPASS nomenclature. COMPASS considers two levels of indenture below the end item: LRUs and SRUs. Figure 5-1 shows the indenture levels considered.

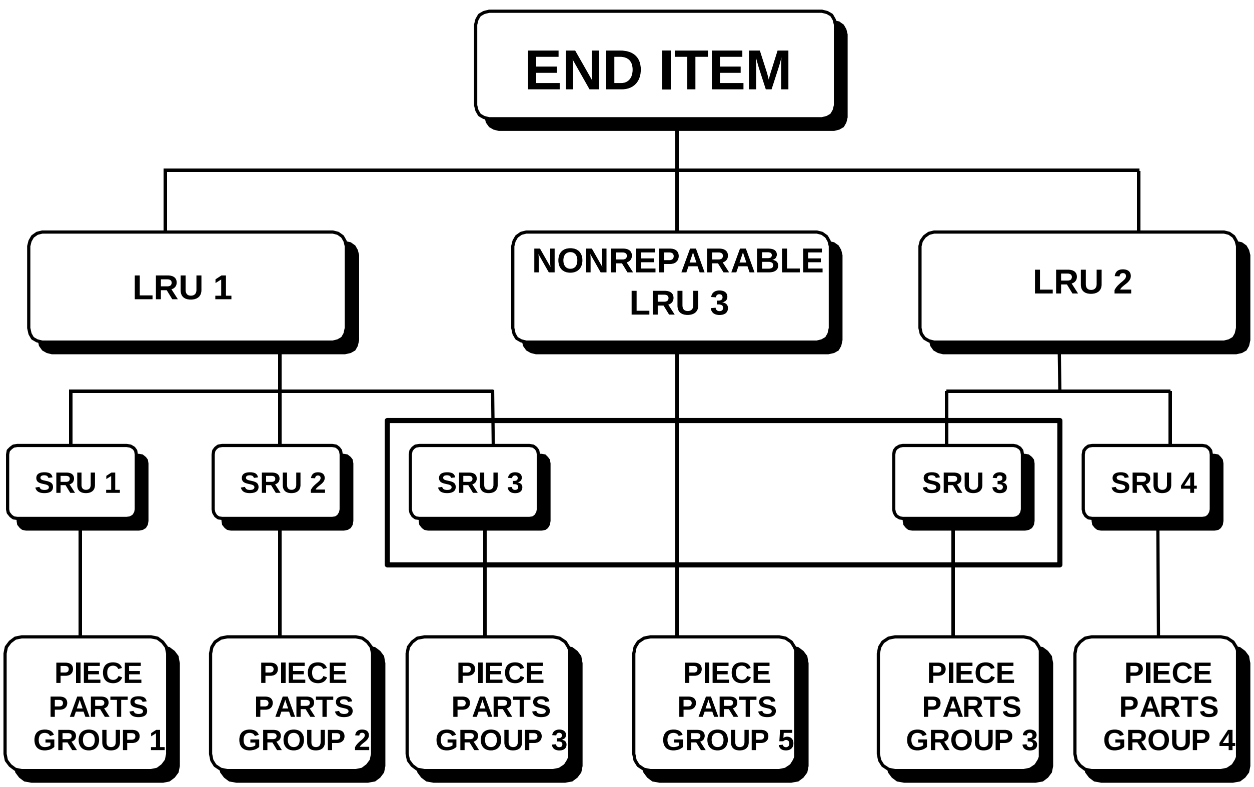


Figure 5-1

5.1.1 Indenture Level 1 – End Item

The highest level of indenture within COMPASS is called the end item. In actuality, the highest level could be a system, an end item, a major assembly of an item, or an item itself. It depends on which indenture levels the user wishes to model.

5.1.2 Indenture Level 2 – LRU and NLRU

An LRU is an item that is removed and replaced to restore the end item to an operationally ready condition. It is removed directly from the end item. The LRU must have a lower level of indenture (i.e an SRU or an NSRU). COMPASS will not ask the user to input the Mean Time Between Failure (MTBF) of the LRU. The MTBF of the LRU is calculated by rolling up the failure rates of all SRUs and non-repairable SRUs that make up the item. Each LRU must have a unique name.

A non-repairable LRU (NLRU) is also an item that is removed and replaced to restore the end item to an operationally ready condition. It is treated as the same indenture level as the LRU; however, these items have been predetermined by the analyst to be throwaway items. Since they are maintenance significant, they must be stocked in sufficient quantities in order for the end item to achieve its operational availability goal. Unlike an LRU, a NLRU does not need another level of indenture below it. For this reason, COMPASS will ask the user for the MTBF of the NLRU. The non-repairable LRU is usually made up of piece parts and COMPASS will ask the user to input the total number of parts and the average cost of the parts that make up the NLRU. Another possibility for NLRU piece parts involves throwaway items such as gaskets, washers, and similar items that are required in the repair of some items. If the NLRU is a single item (has no parts) then the total number of parts would be input as one and the average price would be the unit price of the NLRU.

5.1.3 Indenture Level 3 – SRU and NSRU

SRUs are items that are part of an LRU. Removing and replacing the SRU will repair the failed LRU that has been removed from the end item. COMPASS will ask for the MTBF of the SRU. The user has the ability within COMPASS to include the same SRU in different LRUs. This case is shown in Figure 5-1 where SRU 3 is part of both LRU 1 and LRU 2. In COMPASS, the basic SRU data is only input once. The user has the capability to enter different MTBFs for the SRU according to the SRUs application. An application is the failure mode of a specific SRU-LRU combination. The SRU may be made up of piece parts, which are considered in an aggregate form. The user does not have to input every piece part that makes up the system. Instead, the user will be asked what is the average number and cost of piece parts that make up the SRU.

A non-repairable SRUs (NSRU) is an item that is also part of an LRU. Unlike the SRU, the user has predetermined that the NSRU cannot be repaired. NSRUs are treated at the same indenture level as the SRU. The user inputs the MTBF of the NSRU. Like a SRU, the same NSRU can be part of different LRUs. The NSRU may also be a collection of piece parts. COMPASS will ask the user what is the average number and cost of piece parts that make up the NSRU. NSRU piece parts may also include throwaway items required for repair. If the NSRU is a single item then the total number of parts would be input as one and the average price would be the unit price of the NSRU.

5.2 Inputs That Affect Other Inputs

When building or modifying a COMPASS input data file, there are numerous inputs, that when answered, will determine what additional inputs will be asked later. These inputs reside on the SYSTEM INFORMATION, END ITEM, LRU, NLRU, SRU, NSRU, and SPECIAL screens of the input file. The following sections provide insight on these inputs and what effect they have on other inputs.

5.2.1 Is the End Item Really an Assembly

This question is found on the SYSTEM INFORMATION screen. This question is used if the user wants to determine the stockage requirements of the top indenture level. For example, the engine of an M1 tank must be modeled. Since the engine is really an assembly within a larger system, the user needs to calculate the spares requirement for the engine. Rather than enter all the data for the M1 tank, the user can model the engine as an assembly by answering “Yes” to this question. If the user answers “Yes” to this question, COMPASS will compute stockage requirements for the end item (i.e., the engine). If the user answers “Yes” to this question, the END ITEM screen will enable two additional input fields, which are: “Annual Number of Discards;” and the “Turn Around Times.” The “Annual Number of Discards” has the same impact as LRU and SRU washout rates. It is not a rate, however, but is the actual number of end items that must be discarded annually because they cannot be repaired. Also, when this question is checked “Yes”, two inputs normally on the END ITEM screen will not appear, which are: "DS Delay Cost," and "DS Delay Time." The DS delay time and cost is only considered when repairing an end item. Since the user identified this item as an assembly and not an end item, a DS delay time and cost will not be considered.

5.2.2 Do you want to consider End Item floats

This question is also found on the SYSTEM INFORMATION screen. A “Yes” answer will display two additional inputs on the END ITEM screen. The two additional inputs are: “Annual Number of Discards;” and the “Turn Around Times.” It will also enable the <Float> button on the End Item. Clicking on the <Float> button pops up the Float Information data entry screen. The Float information screen must be filled out. Finally, on the LRU and NLRU screens, COMPASS will ask the user, “Will failure of this item result in issue of a float?” This question must be answered yes for each LRU/NLRU whose failure will cause a float end item to be issued.

5.2.3 Do you want to Consider Contractor Repair

This question is found on the SYSTEM INFORMATION screen. If the user answers “No”, the contractor repair option will not be displayed on any subsequent screens. If the user answers “Yes”, an additional column labeled “CONTR” will be enabled under the SYSTEM ECHELON PLACEMENT heading. The user will be asked whether the contractor is allowed to repair the LRUs, SRUs, or End Item (if modeling end item as an assembly). These inputs allow the user to consider contractor repair while also restricting the indenture levels at which contractor repair can be considered. The answers to these inputs will determine whether the contractor repair option is available on the End Item, LRU, and SRU screens. For example, suppose the user checked “Yes” in the “CONTR” column for the LRU, therefore, on the LRU screen, the question "Do you want to consider contractor repair of this LRU?" is enabled. Answering, “Yes” will enable the <Contractor> button. Clicking on the <Contractor> button pops up the contractor repair data entry screen. The same scenario holds true for the end item and SRUs.

5.2.4 Does the System Have Any Redundant LRUs

This question is found on the SYSTEM INFORMATION screen. Redundancy within COMPASS refers to having two or more identical LRUs within the end item that perform the same function. The system is operable so long as a defined minimum number of the LRUs are functioning properly. Answering “Yes” to this question will enable the question, "Is this LRU redundant?" on each LRU and NONREPARABLE LRU screen. A “Yes” answer enables the <Redundancy> button. Clicking on the <Redundancy> button brings up the “LRU REDUNDANCY” data screen that needs to be completed.

5.2.5 Run mode

This question is found on the SYSTEM INFORMATION screen. The user has three options to this question: Normal, Screening, or Multiple Repair. Since the "Normal" option is the basis for the data file structure, it has no effect on the altering of inputs. The options, "Screening" and "Multiple Repair," do have an effect on other inputs.

If “Screening” is selected, the “SREENING ECHELONS” inputs will be enabled. If the user authorizes one of the maintenance levels the ability to screen the end item, LRU or SRU, then on the end item screen and on each LRU/SRU and NLRU/NSRU input screens, COMPASS will enable the question: "Can the item be screened?" Answering, “Yes” to this question will enable the “SCREENING” button. Clicking on the “SCREENING” button will pop up the Screening Alternative input screen that must be completed. Even though NLRUs and NSRUs are not repaired, the user does have the ability to screen these items for false removals before the item is thrown away.

A check for the "Multiple Repair" run mode will affect the end item, LRU, NLRU, SRU, and

NSRU screens. The maximum number of repair alternatives for any item is three. On the End Item, LRU, and SRU screens, the question "Number of Repair Alternatives" will allow the user to select from up to 3 repair alternatives instead of one. The number of repair alternatives input will dictate the how many <ALT#> (<ALT1>, <ALT2>, and <ALT3>) buttons are enabled. All of the <ALT#> buttons must be pressed and their corresponding repair alternative screens completed. On the NLRU screen, setting the answer to the question "Number of End Item Repair Alternatives peculiar to the LRU" to yes, enables the "PECULIAR REPAIR" button. Clicking on this button brings up the Peculiar Repair data input screen. The number of repair alternatives will now correspond to the number of end item repair alternatives. The Peculiar repair for the NSRU is located under the "ADDITIONAL INFORMAITON" heading on the NSRU screen. Clicking on the <MTBF> brings up the "Add Rep" box along with the box for entering the associated LRU and MTBF information. Setting the "Add Rep" box to "YES", displays the Peculiar Repair data entry screen. The Repair Alternatives selection on the Peculiar Repair screen now corresponds to the number of repair alternatives allowed for the SRUs associated LRU's.

5.2.6 Echelon for Repair of the End Item

This question is found under the REPAIR ECHELONS heading of the SYSTEM INFORMATION screen. If the user selects "Yes" to end item repair at the DSU, the two inputs, "DS Delay Cost" and "DS Delay Time", are enabled on the END ITEM screen. However, if the question "Is the end item really an assembly?" is answered, "Yes" then the "DS Delay Cost" and "DS Delay Time" will not be enabled. The DS delay refers to a contact team which are repairmen assigned to a DSU maintenance facility. These repairmen are authorized to travel to the organizational level or wherever the end item is, to perform repair of the end item. If a contact team is used, the repair is considered a DSU maintenance action. The output will reflect this by indicating the End Item repair level is DSU and generating a cost for the contact team.

5.2.7 End Item Repairs Peculiar to this LRU

This question is found on the LRU and NLRU screens. Answering "Yes" to this question will enable the <PECULIAR REPAIR> button. Clicking on the <PECULIAR REPAIR> button pops up the "PECULIAR REPAIR" data entry screen. This screen needs to be completed. An example of when this type of input may occur follows. An end item that is made up of three LRUs named LRU #1, LRU #2, and LRU #3. A repairman may always need common support equipment to repair the end item when it fails. However, when the end item failure is due to the failure of LRU #1, the repairman may need an additional piece of support equipment (i.e., a piece of calibration equipment). Therefore, the calibration equipment is needed only when LRU #1 fails, not every time the end item fails.

5.2.8 Add Repair

This question is found on SRU and NSRU data screens next to the MTBF inputs. This input is used when there is peculiar repair of the LRU due to failure of this SRU. Setting the answer to "YES" will cause the "PECULIAR REPAIR" data entry screen to be displayed, which needs to be completed. If COMPASS is executed in the Multiple Repair run mode and the SRUs associated LRU has more than one repair alternative, the correct LRU repair alternative will need to be selected from the repair alternative box. This input is similar in principle to the end item repair peculiar to an LRU. The difference is the SRU/LRU is at issue instead of the End Item/LRU combination.

5.2.9 Will Contractor Receive Equal Proportion of Failures

This question is found on the SPECIAL ANALYSIS. The default answer for this question is "Yes". Answering "No" to this question and "Yes" to the question, "Do you want to consider contractor repair?" on the SYSTEM INFORMATION screen will add the input, "Contr Cost" on the SRU and NSRU screens.

5.2.10 Do you want to Spare to Availability

This question is found on the SPECIAL ANALYSIS screen. The default answer is "Yes". Answering "No" will invoke the standard initial provisioning computations for computing stockage requirements, which is the old methodology for provisioning. Current Army policy mandates "sparing to availability." Answering "No" to this question will require two additional inputs on the SUPPLY information screen: retail stockage criteria, and the operating level at ORG, DSU, and GSU.

5.3 Sensitivity Analysis

No LORA analysis should ever be completed without performing sensitivity analysis. Sensitivity analysis is conducted to determine what effect changing logistics parameters will have on the overall maintenance concept of the system. Sensitivity analysis should be performed on those data elements that the analyst is very uncertain on the value (due to inadequate data, pushing state of the art, etc.).

Sensitivity analysis is performed by altering the input file, or the policy file, and running the optimizer or evaluator. Output from an optimizer run along with the original input data should serve as a base line from which additional runs will be compared to. If the user wishes to determine what effect changing the optimum policy has on overall life cycle cost, the policy file generated by the optimizer run can be modified. The evaluator is then run using the modified policy file. The user will have to manually compare the output products to determine the impact of altering the maintenance concept. The user can then determine at what point maintenance concepts may change.

Performing sensitivity analysis allows the analyst to determine a range of values for inputs and what affect this range will have on the overall logistics structure. The degree of confidence in the data will vary depending on the phase of the life cycle you are in and the system being modeled. The parameters selected for conducting sensitivity analysis will also vary. Table 5-1 lists some of the more common parameters on which sensitivity analysis is performed. The table also lists the effect altering these values may have on the overall system.

INPUT	EFFECT ON THE OVERALL SYSTEM
Mean Time Between Failure (MTBF) of an item	The higher the MTBF, the more likely the item will be evacuated further back for repair. Raising the MTBF high enough will eventually change the maintenance concept from repair to discard.
Unit price of an item	The higher the unit price, the more likely repair will be shifted rearward. Lowering the unit price will eventually change maintenance concept from repair to discard.
Turn around time/ Order ship time	These two inputs play a major role in the logistics downtime. The lower the logistics down time between echelons, the more likely repair will be shifted rearward.
False removal rate	False removal rate affects the number of maintenance actions that must be performed by the maintenance echelons. The higher the false removal rate, the higher the maintenance cost. For this reason, raising the false removal rate will make screening the item a more viable alternative.
Test Program Set (TPS) Cost	If an item is repaired, then TPS cost associated with that item will be charged against that system. If the item is discarded, no TPS cost will be charged. The higher the TPS cost, the more likely the item will be discarded instead of repaired.

Annual Operating Hours	The higher the annual operating hours, the more failures of each item. More failures will shift items toward repair instead of discarded because all fixed costs are being distributed over a greater number of failures. Increasing annual operating hours will also increase number of consumption spares, transportation cost, SE, and manpower cost, etc.
Density	The higher the density, the more likely items will be repaired instead of discarded because all fixed costs are being distributed over a greater number of items. Higher density will also increase all cost elements.
Life	Increasing the life of a system will shift items more toward repair because certain fixed costs (i.e., cost to develop and install support equipment, cost to develop TPSs) will be distributed over a greater number of failures.
Washout rate	Increasing the washout rate of an item may shift items from repair toward discard. Consumption spares cost will increase.
Support equipment repairman cost	As cost increases, the maintenance cost will shift toward repair rearward for peculiar items. Increasing cost may eventually change maintenance concept from repair to discard.

Table 5-1

5.4 Advanced Modeling Techniques

This section is intended to provider users with additional modeling techniques to handle situations that don't fit in with basic modeling scheme present elsewhere.

5.4.1 Modeling a LRU that has no SRU

The COMPASS model requires that each reparable LRU contain at least one SRU. Not all systems can be modeled to adhere to this requirement. In such a case, the user should enter a NSRU having a low unit price, no weight, a False Removal Rate of zero, and a Mean Time Between Failure (MTBF) equal to the LRUs MTBF. A NSRU modeled in this manner is termed a "dummy" or pseudo SRU. The parameter values are repeated below:

```
Unit Price      = $0.01
Weight          = 0.0 lb
FRR             = 0.0
MTBF            = LRU MTBF
```

Using these values, the only significant costs that will be incurred due to the dummy SRU will be supply related. These costs are then subtracted from the total logistics cost found in the Optimizer report. An example is provided below.

```
TOTAL LOGISTICS COST       52,564,849
DUMMY NSRU COST            - 21,735__

TRUE TOTAL LOGISTICS COST  52,543,114
```

5.4.2 Modeling a System That Contains Multiple Non-Redundant LRUs

Users may encounter a system that contains the same LRU in different locations. Each LRU is independent of the others and not redundant, so if one fails the system will be rendered inoperable. This scenario is demonstrated in the diagram below. LRU A is the multiple LRU.

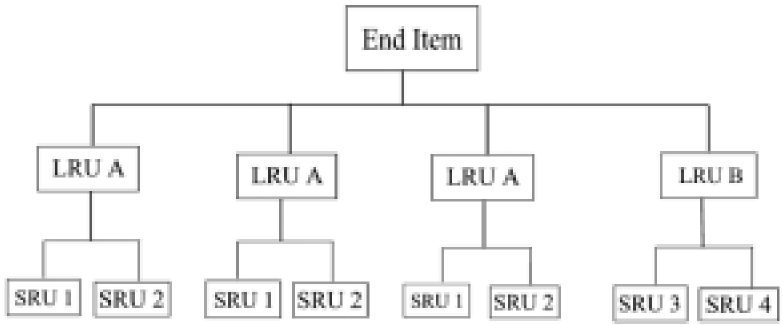


Figure 5-2

One may assume that it is acceptable to model each LRU A individually. However, the resulting total cost of the system will be excessive. This is due to some supply related costs being calculated three times instead of one. Spares estimates may also be skewed for this LRU because the model will be computing stockage for three separate items instead of one.

The correct method of modeling this system is to divide the MTBFs of the SRUs that comprise the multiple LRU by the number of times it appears in the system. Modeling in this manner will account for the increase in failures of the LRU without incurring multiple costs for supply related charges associated with each distinct LRU. For example, consider an LRU that is present in five distinct locations of a system. The LRU has two SRUs, one that has a MTBF of 10,000 hours and the other having a MTBF of 30,000 hours. The LRU is entered into the system one time, and the MTBFs of the SRUs will be 2,000 hours and 6,000 hours, respectively. The proper block diagram for this system is shown below.

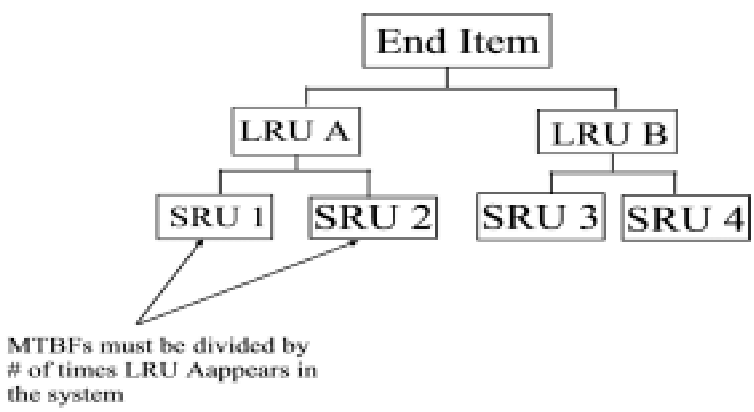


Figure 5-3

5.4.3 Modeling an LRU within and LRU

The following diagram represents a basic system.

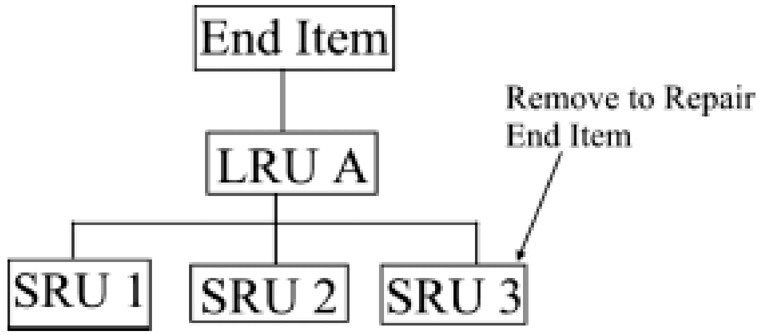


Figure 5-4

Consider, however, that SRU 3 can be directly removed and replaced to repair the End Item without removing LRU 1. Physically SRU 3 is a component of LRU 1, but it should be modeled to uniquely reflect the capability to repair the End Item. This concept is illustrated in the following diagram.

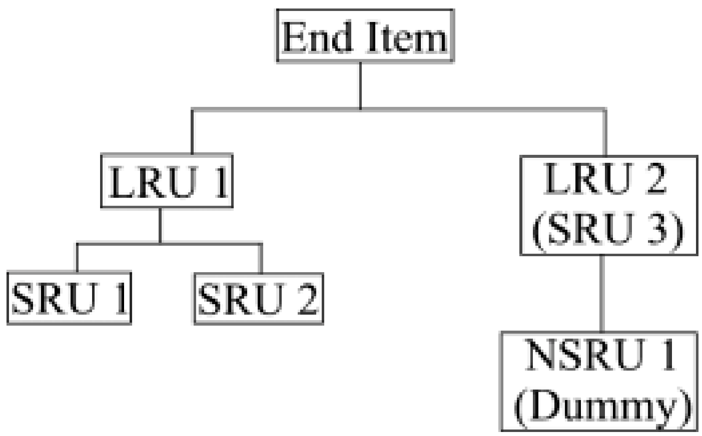


Figure 5-5

Remember that a failure of either SRU 1 or SRU 2 will result in the removal of LRU 1. In order to reflect true spares costs, the unit price of SRU 3 (the new LRU 2) should be subtracted from LRU 1. The MTBF of SRU 3 is now entered in the NSRU 1 (the Dummy SRU) information. Remember that all costs associated with NSRU 1 must be subtracted from the overall system cost.

5.4.4 Modeling a System That Has More Indenture Levels than COMPASS Can Handle

Many systems that are to be modeled will exceed the COMPASS limitation of three indenture levels. These systems can be modeled using COMPASS. The following diagram represents a system that has four indenture levels.

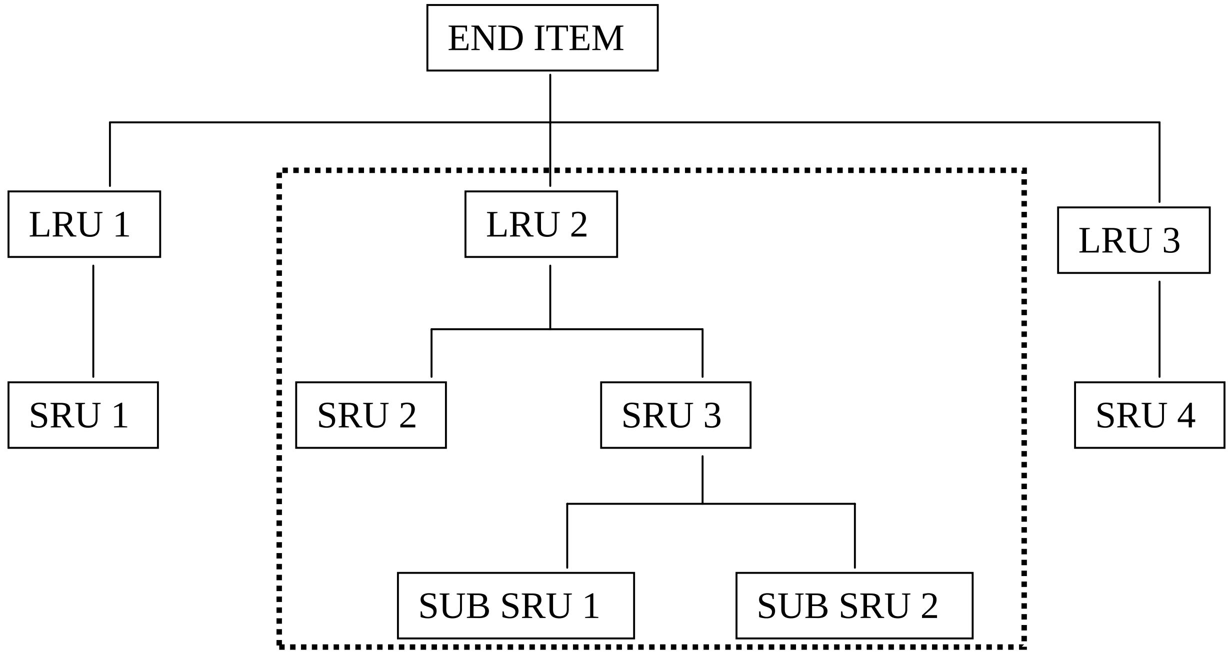


Figure 5-6

The proper approach to model this system begins with selecting the subject areas containing the lowest indenture levels. In this example, the subject area is LRU 2 and its subordinates. The diagram shown below demonstrates how this area can be modeled separately so that later it can be incorporated into the overall system.

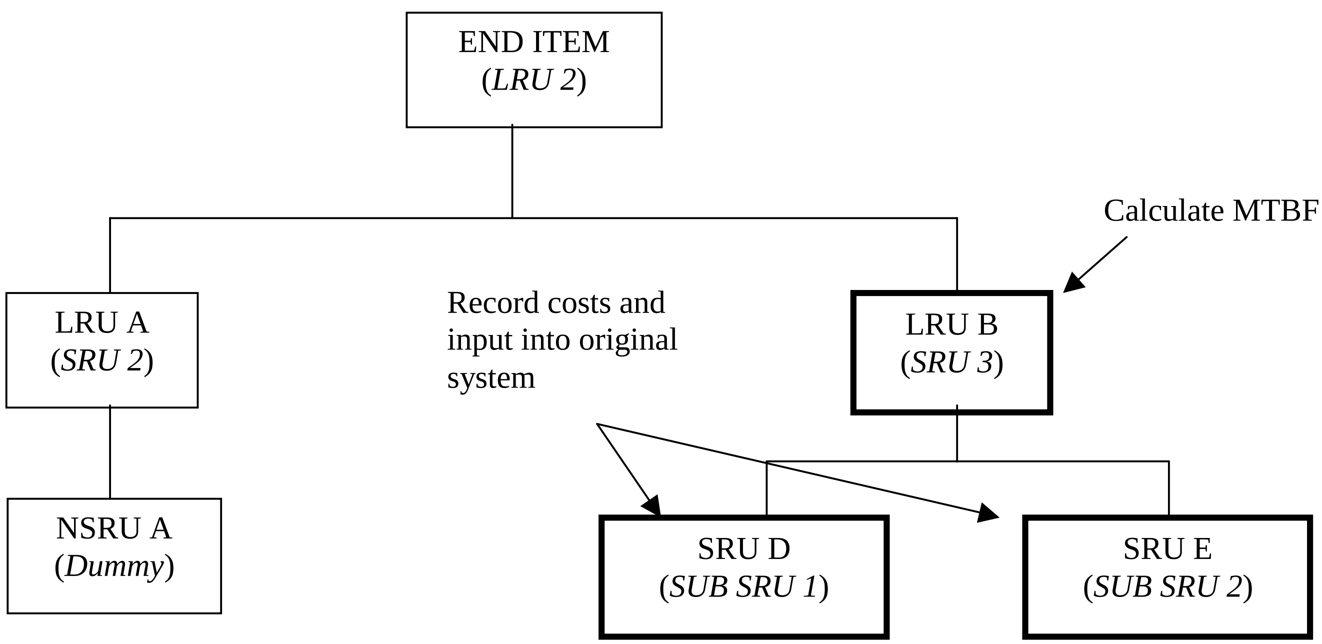


Figure 5-7

LRU 2 is modeled as the End Item, and SRUs 2 & 3 associated with LRU 2 are represented as

LRUs A & B. The SUB SRUs are modeled as SRUs D & E. A Dummy NSRU must be included to input the MTBF of SRU 2. When this portion of the system is modeled separately, the costs associated with the SUB SRUs are determined, recorded, and later added to the original system costs. LRU B's MTBF is calculated from the MTBFs of the SUB SRUs and is input into the original system as SRU 3.

The original system can now be represented with the following diagram.

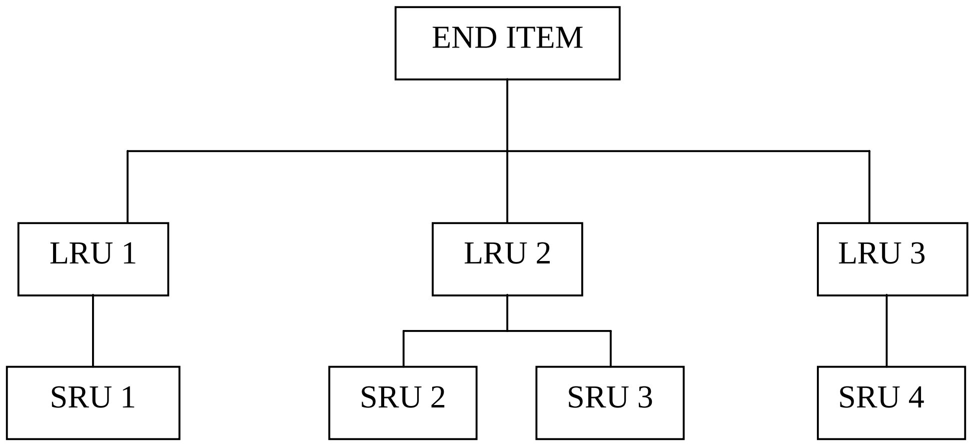


Figure 5-8

Note that the SUB SRUs have been eliminated due to their associated costs being calculated in the previous run. Remember to add in the costs of the SUB SRUs when the cost of this system is calculated.

Troubleshooting andTechnical Support

Technical Support

The COMPASS Help Desk Phone Numbers are:

(256) 955-8370/9834
DSN   645–8370/9834
Fax: (256) 955-9078

Information and updates can also be obtained from the COMPASS Web Site at www.logsa.army.mil/alc/compass.

Troubleshooting

Path/File access error

This error sometimes occurs whenever the FEA shuts down in the middle of executing. The FEA routine used in COMPASS is a holdover DOS program from COMPASS 2.3. A limitation of DOS based programs is that they don't recognize long path names (i.e. C:\Program Files\Compass). To get around this problem COMPASS will create a temporary directory for the FEA program to use. The temporary directory is called C30DIR. It is found off the root drive where the data files are stored (i.e. C:\C30DIR). The temporary directory is normally erased. To correct the error, exit compass and delete the temporary directory.

Files from a previous run were found

This happens when an Optimizer run stopped and COMPASS didn't get a chance to clean up the temporary files created by this process. The Optimizer can't complete its sequence with the temporary files being in the way. Clicking on the <OK> button will move the files to the "tapfil" directory, which is located as a sub directory to the "COMPASS" directory. The user must then re-execute the optimizer.

Optimizer can't execute Global Command

This message means that the Optimizer can't generate a feasible solution. This is usually caused by the number of failures being extremely high. Try adjusting the MTBF multiplier upwards and if the error goes away then the input MTBF values need to be examined.

Output Cost exceeded a billion dollars

Costs exceeding a billion dollars cause the current version of the Evaluator to stop. Use the scaling factor setting in the <Special> data screen to scale the costs in the input file. This will allow the Evaluator to run normally.

Appendix A

Data Elements

This appendix provides definitions and explanations for data elements found in the Computerized Optimization Model for Predicting and Analyzing Support Structures (COMPASS) program.

<u>ADD REPAIR</u>. This input is used when there is peculiar repair of the LRU due to failure of this SRU. This question has two options: (a) When COMPASS is run in the normal or screening run mode, it requires a yes or no answer; (b) When COMPASS is run in the multiple repair run mode, it requires the number of LRU repair alternative(s) requiring additional information when this SRU causes the failure of the LRU. The maximum additional repair alternative is three. Occasionally there are SE or repairmen that are not needed every time the LRU fails, but are needed when the failure is caused by a specific SRU. If you answer yes to this question, or input a number every time the identified LRU fails due to the failure of this SRU, COMPASS assumes all SE and repairmen identified on the additional repair alternative data screen are required to repair the LRU in addition to those identified under the LRU's repair alternative(s).

<u>ANNUAL AVAILABLE SE HOURS</u>. The total number of hours per year the SE may be used for fault isolation, screening and/or repair.

<u>ANNUAL COST TO MAINTAIN SE</u>. The annual recurring cost required to maintain the SE in an operational state. The value can be obtained by multiplying the unit price times the support of SE cost factor.

<u>ANNUAL COST TO MAINTAIN TPS</u>. The annual cost, in dollars, required to maintain the TPS.

<u>ANNUAL OPERATING HOURS</u>. The total hours the item under analysis is expected to be operated during a calendar year.

<u>ANNUAL NUMBER OF DISCARDS</u>. The number of failures that are not repaired due to physical damage or loss of the failed item. This input is only required when you input a yes for either: "Is the end item really an assembly?"; or "Do you want to consider end items floats?"

<u>ANNUAL SALARY</u>. This input represents the unloaded base annual salary of the repairman or SSC. It may vary by maintenance echelon.

<u>ANNUAL TPS MAINTENANCE COST</u>. The annual cost, in dollars, required to maintain the end to end TPS.

<u>ANNUAL TURNOVER RATE</u>. The portion of personnel, expressed in percent per year,

leaving their SSC that will be replaced by new personnel requiring training.

ARE THERE END ITEM REPAIRS PECULIAR TO THIS LRU. This question is asked when running COMPASS in either the normal or screening run mode. Occasionally there are SE or repairmen that are not needed every time the end item fails, but are needed when the failure is caused by a specific LRU. If you answer yes to this question, COMPASS will prompt you for additional information (End Item repair peculiar to this LRU data screen).

AVAILABILITY TARGET. The probability that, when used under stated conditions, a system will operate satisfactorily at anytime.

CAN SRUS BE PROMOTED TO LRUS. This input is either "Yes" or "No". When input as "Yes" (default) it allows COMPASS to "promote" or "elevate" an SRU to the LRU level, if the washout rate of the LRU is close to zero. When this occurs, the assumption made is that the LRU is not stocked, but will be repaired in a time equivalent to the hands on repair time rather than the turn around time, which is a more realistic time for lower priority repairs. If this is not feasible for the system, answer "No" to this question. The Non Biased Stockage Optimization is used by COMPASS to compute a more optimal SESAME stockage list versus the normal SESAME routines which tends to give bias towards stocking some higher priced, perceived important, LRU's in the field.

CAN SRU's BE PROMOTED TO LRU's. This input is either yes or no. COMPASS may promote an SRU to an LRU if the LRU washout rate is close to zero. When this occurs, the assumption made is the LRU is not stocked, but will be repaired in a time equivalent to its hands on repair time rather than the turn around time, which is a more realistic time for lower priority repairs. If this is not feasible for your system, answer no to this question. The default input is yes.

CAN END ITEM BE SCREENED. This question will only be displayed on the End Item data screen for the following scenarios: (a) when the run mode is set to screening and modeling "End Item Floats" or (b) when the run mode is set to screening and modeling the "End Item as an Assembly" (a "yes" is required in "Echelons Available for Screening"). If you answer yes to this question, an additional input data screen pertaining to screening information will be displayed (refer to paragraph 4.8.8 for screening data requirements)

CAN THE LRU/NLRU/SRU/NSRU BE SCREENED. Answer yes if you want to consider go/no go testing (screening) of the item to determine if it is an actual failure before the item is shipped to the required maintenance echelon for repair. Answer no otherwise. When this question is answered yes, COMPASS will display an additional input screen (called Screening Data) pertaining to screening of the item as discussed below.

COMMON LABOR DATA. For each maintenance action, a repairman is used to perform the repair. If a special repairman is not required, then COMPASS will charge the effective labor cost of a common repairman. The labor rate can be entered as the unloaded base hourly labor rate, or as an effective hourly labor rate. If both inputs are filled out, the effective hourly labor rate will be used for all calculations by COMPASS.

CONTR COST. This inputs represents the additional cost the contractor will charge to repair the LRU when this SRU fails. When the LRU fails due to the failure of this SRU, what is the cost, in dollars, the contractor will charge to repair the LRU? This question is only asked when the following is done: (a) answer "NO" to will contractor receive equal proportion of the failures on the Special Analysis data screen; (b) answer yes to do you want to consider contractor repair on the System Information input screen; and (c) input yes under CONTR echelon for LRU and SRU on the system echelon placement screen.

CONTRACTOR RESPONSE TIME. The average elapsed time (in days) from the time the item leaves a government maintenance facility until it is repaired by the contractor and returned to a government supply facility. This input is similar to the government's order ship time plus turn around time.

COST ($/lb). The transportation rate, expressed in dollars per pound, for transportation of material between maintenance echelons.

COST OF TECHNICAL DOCUMENTATION. The average cost to develop one page of technical documentation.

COST PER FAILURE TO REPAIR ITEM. The contractor cost per failure to repair an item, if it is in fact a failed item. This cost includes transportation costs of shipping the item to/from the contractor and diagnostic cost.

COST PER REQUISITION. The administrative cost in dollars and cents to prepare and submit a requisition for a replenishment spare/repair part.

CURVE PARAMETER MULTIPLIER. The selected curve parameter is multiplied by this factor for special analysis. The default value is 1. A value of zero will result in an error and the model will not complete the evaluation.

DIAGNOSTIC COST. The cost the contractor charges per failure to repair an item, if the item was found to have no evidence of failure.

DIAGNOSTIC TIME. The time required to fault isolate to the item causing the failure (does not include time for corrective action). Therefore, washouts and false removals will only be charged for this diagnostic time.

DIRECT PRODUCTIVE ANNUAL MANHOURS. The total annual number of man-hours for which an SSC is available to perform assigned tasks.

DISCOUNT RATE. The interest rate used to discount or calculate future costs and benefits in order to arrive at present value per DODI 7041.3. The discount rate includes an adjustment for inflation. By regulation, the discount rate should be set to 10 percent; therefore, the default value is 4 percent.

DISTANCE. The geographical distance, in miles, between two maintenance echelons.

DO YOU WANT TO CONSIDER END ITEM FLOATS? Input a yes, only if the system being modeled has spare end items which are to be issued when a specific LRU fails. Otherwise, answer no to this question. Systems which generally warrant being modeled in this manner are low cost, high density items.

DO YOU WANT TO CONSIDER CONTRACTOR REPAIR? If you want to consider contractor repair of the end item/LRUs/SRUs, along with organic repair, input yes. Only applies to the end item when either “End Item Floats” or “End Item as an Assembly” is answered “YES”.

DO YOU WANT TO SPARE TO AVAILABILITY. This input requires a yes or no response. Current Army policy states that there should be no lower bound on stockage. Therefore, the default input is "Yes". When input as “Yes”, COMPASS, through the use of the SESAME supply algorithms, will calculate stockage requirements necessary to meet the availability target. In the past, stockage requirements were based on SIP computations which served as the lower bound. When the user answers “No” to this question, two additional inputs, "Operating Levels by Echelon" and “Retail Stockage Criteria”, will be displayed on the supply data screen.

DOES SYSTEM HAVE ANY REDUNDANT LRUs? Redundant LRUs are two or more identical LRUs in which failure of one of the LRUs will not result in failure of the end item. If you system has redundant LRUs, input a yes.

NOTE: *A system containing redundant LRUs is not the same as one having multiple identical LRUs, in which a failure of one LRU causes the end item to fail.*

DOES THE LRU/NLRU/SRU/NSRU HAVE AN NSN. Answer yes if the item has already been assigned an NSN; otherwise, input no. This input is used in calculating the cataloging costs.

DS DELAY COST ($/event).
This input is based on the operational scenario you want to model.

FIRST SCENARIO. Use of a DS Contact Team to Repair End Item. In some cases, you may be authorized to send DSU personnel to the organizational level to repair the end item by removing/replacing the faulty LRU. For this scenario, this input represents the cost incurred each time an LRU is replaced using a DS contact team. This cost covers only the cost of getting the contact team to a site (i.e., where end item is located), not the hands on repair costs. COMPASS uses this cost in developing the total repair cost for the end item when repair is done using a DS contact team.

SECOND SCENARIO. DSU Personnel Recover End Item and Evacuate it back to the DSU Shop for Repair. In this case, you are authorized to have DSU personnel travel to the site (i.e., where end item is located), and evacuate the end item to DSU shop for repair and then return to the user. This scenario does not authorize use of a DS contact team. The cost input here represents: (a) cost of transporting the DSU personnel to the end item site and returning to the DSU shop; (b) cost of recovering and transporting the end item back to the DSU shop (i.e., towing, loading on truck, etc.) and returning it to the user after repair; and (c) cost of transporting the DSU personnel back to the end item site, after repairing it, and returning back to the DSU shop. This cost does not include the hands-on cost associated with actual repair of the end item. COMPASS uses this cost in developing the total repair cost for the end item when repair is done using DSU personnel sent to recover the end item.

DS DELAY TIME (Hours). This input is based on the operational scenario you want to model as described below:

(a) Use of a DS Contact Team to Repair End Item. In some cases, you may be authorized to send DSU personnel to the organizational level to repair the end item by removing/replacing the faulty LRU. For this scenario, this input represents the Contact Team Delay Time (time (in hours) required for a contact team to travel from the intermediate maintenance location to the organizational location).

(b) DSU Personnel Recover End Item and Evacuate it back to the DSU Shop for Repair. In this scenario, this input represents the time it takes for the DSU personnel to travel to the end item site, recover the end item, return to the DSU shop, and then return the end item back to the user after repair is complete.

ECHELON AT WHICH END ITEM FLOAT CAN BE ISSUED. Identify the echelon which is authorized to issue a float (spare end item). If the end item is really an assembly, this should be the ORG level. Otherwise, this input should normally be the DSU. It is possible that even though you identify the echelon at which a float can be issued as DSU, COMPASS may find it feasible (in terms of achieving operational availability) to stock the floats (spare end items) at an echelon further back than the one specified. This input screen is only displayed if a "YES" is answered to "Do you want to consider end item floats?" on the system echelon placement screen.

ECHELONS AVAILABLE FOR REPAIR. This input identifies the maintenance echelons to be considered in the repair of the end item/LRU/SRU. When considering contractor repair, "Echelons Available for Repair" will contain one additional echelon labeled, "CONTR", which represents the contractor's facility.

ECHELONS TO SCREEN. Use these inputs to identify those maintenance echelons that should be considered to perform go/no go testing on the end item/LRUs/SRUs. Screening of the item cannot take place at the same echelon the item is repaired; therefore, no screening may take place at the ORG level. These inputs will only be displayed when COMPASS is run in the screening run mode.

ECHELON TO SHIP TO CONTRACTOR. The echelon from which the item is shipped to the contractor. Normally the echelon that ships the item to the contractor is also the echelon that receives the item back from the contractor. In most instances, the echelon that ships to the contractor will not vary by item.

ECHELON SHIPPED FROM CONTRACTOR. The echelon that receives the item back from the contractor. Normally the echelon that ships the item to the contractor is also the echelon that receives the item back from the contractor. In most instances, the echelon that receives the item back from the contractor will not vary by item.

EFFECTIVE HOURLY LABOR RATE. The average loaded labor rate per hour for a repairman at a given maintenance echelon. This rate takes into account the repairman's unloaded hourly rate, productivity factor, and loading factor.
The effective hourly labor rate is calculated by the following formula when the user inputs the unloaded labor rate:

$$\text{EFFECTIVE HOURLY LABOR RATE} = \frac{\text{(UNLOADED BASE HOURLY RATE) * (1 + LOADING FACTOR)}}{\text{(PRODUCTIVITY FACTOR)}}$$

END ITEM DENSITY (No. of End Items). The total number of systems to be fielded worldwide for operational use. This number should not include those end items that are set aside as floats or spares.

END ITEM FLOAT DATA. This screen contains input data pertaining to End Item Floats as discussed below.

ESSENTIALITY CODE. A code to indicate the degree to which the failure of the part affects the ability of the end item to perform its intended operation. Listed below are the codes and corresponding meaning:

1 - Failure of this part will render the end item inoperable.

3 - Failure of this part will not render the end item inoperable.

5 - Item does not qualify for the assignment of code 1, but is needed for personnel safety.

6 - Item does not qualify for assignment of code 1, but is needed for legal, climatic, or other requirements peculiar to the planned operational environment of the end item.

7 - Item does not qualify for the assignment of code 1, but is needed to prevent impairment of or the temporary reduction of operational effectiveness of the end item.

FALSE REMOVAL RATE. The fraction, expressed in decimal form, of removals that are operational items.

FLOAT COMPUTED PER OPTIMIZATION (vs. regulation). This question requires a yes or no answer. When input as no, you have the option to see the cost effective amount of float stock, or the amount of float which would be computed by current regulation. If you want COMPASS to compute only the most cost effective amount of float stock, input a yes. The default is no. The input may be changed from "No" to "Yes" when running the evaluator to determine how many spare end items COMPASS would compute. There is a possibility, however, the operational availability goal may not be achieved in this manner.

HOLDING COST FRACTION. A percentage of inventory value to account for storage, loss, obsolescence, and interest cost incurred as a result of maintaining inventory.

INITIAL BIN COST. The initial cost, in whole dollars, of entering a item into the retail supply system. This includes the administrative cost of setting up a bin for the item at the wholesale supply point.

INPUT CURVE PARAMETER. The input curve parameter is to be used for advanced analysis. When a proper value is entered, the model can sometimes obtain the optimal solution with fewer iterations. Normally, the default value (0) is used and COMPASS will calculate the appropriate curve parameter automatically. Values other than zero should only be attempted by users with a thorough understanding of the relationship between this input and the Cost vs. Availability curve.

IS THE END ITEM REALLY AN ASSEMBLY? The user should model the end item as an assembly if it is removed and replaced to repair a higher indenture item. By answering yes, COMPASS will compute stockage requirements of this item and will not consider use of a Direct Support (DS) contact team to repair the item.

IS THIS LRU REDUNDANT. This input requires a yes or no answer. Normally the answer to this question will be no. Answer yes only if there is more than one of this particular LRU within the end item and failure of one of them will not result in the failure of the end item. If you answer yes, COMPASS requires additional information regarding redundancy.

INITIAL CATALOGING COST. The initial cost of entering a new item into the wholesale supply system. This is generally considered to be the cost of screening the item and assigning a national stock number (NSN).

INITIAL TRAINING COST (per/person). The cost, in dollars, of training a single SSC.

IS REPAIRMAN USED FOR REPAIR ONLY. Input yes if the repairman is used solely for the repair. For this case, COMPASS will base the cost and requirements of the repairman on the number of actual failures only (i.e., does not include false removals or washouts in the calculations). If input as no, COMPASS will calculate the cost and requirements of the repairman based on all failures, including false removals and washouts.

IS SE USED ONLY FOR REPAIR. This input is yes if the SE is used solely for the repair (i.e., Soldering Gun). When input as yes, COMPASS will base the SE cost and requirements on actual failures only (i.e., does not include false removals or washouts in the calculation). If the SE is used for diagnostics (fault isolation) and screening/repair, then input a no. Then COMPASS will calculate the cost and requirements of the SE for all failures, including false removals and washouts.

LIFE. The number of years the item is expected to be in service.

LOADING FACTOR. A factor which is applied to the hourly and annual manpower costs to account for overhead, benefits, permanent change of station moves, hazardous duty, etc.

LOWEST ECHELON TO REPAIR WHEN FLOAT ISSUED. When a failure occurs that results in the issue of a float (spare end item), this input identifies the lowest echelon authorized to repair the failed item. The lowest echelon to repair, if a float is issued, cannot be below the echelon at which a float can be issued (previous input). For example, if the echelon at which a float can be issued is DSU, then this input cannot be ORG. However, it may be any of the other levels.

LOWEST ECHELON WHERE SE IS AUTHORIZED. This input identifies the lowest echelon at which the SE is authorized. COMPASS automatically assumes the SE may be placed at all echelons higher than the lowest authorized. For example, if you identify the lowest echelon as DSU, COMPASS assumes the SE may also be placed at the GSU and depot.

LOWEST ECHELON WHERE SE IS COMMON. This input is used to identify the lowest echelon at which the SE's resources will be shared among other systems. If the SE is common, your system will only be charged for the amount of time you actually use it. For each echelon where the support is not common, COMPASS will charge off the entire cost of that SE (i.e., development, installation, and maintenance) to your system, if the model determines you need that piece of SE at an echelon where it is not common.

LOWEST ECHELON WHERE REPAIRMAN IS AUTHORIZED. This input is used to identify the lowest echelon at which the repairman is authorized. COMPASS automatically assumes the repairman may be placed at all echelons higher than the lowest authorized. For example, if you identify the lowest echelon as DSU, COMPASS assumes the repairman may also be placed at GSU and the depot.

LOWEST ECHELON WHERE REPAIRMAN IS COMMON. Used this input to identify the lowest echelon at which the repairman's resources will be shared among other systems. If the repairman is common, your system will only be charged for the time the repairman actually is working on your system. For each echelon that was identified as not being common, COMPASS will charge off the entire cost of that repairman (i.e., salary, loading, training), if COMPASS determines you need the repairman at the echelons which are not common.

LRU NAME. Identify the LRU(s) that this SRU is associated with. Different LRUs can contain the same SRU. The LRU identified here must be the same name as you input under the LRU input screen.

MEAN TIME BETWEEN FAILURE. For a particular interval, the total functional life of a population of an item divided by the total number of failures within the population during the measurement interval.

MEAN TIME TO INSTALL. The time, in hours, it takes to install the end item. There are two cases when this value is not equal to zero. The first case is when the end item being modeled is actually an assembly. In this instance, there may be time involved with removing and replacing the modeled end item. Mean time to install may also be non-zero if, once a floated end item is issued and moved to the ORG level, there is additional time to get it to the actual weapon site.

MEAN TIME TO REPAIR WITH THIS ADDITIONAL INFORMATION. Since repair of the end item within this scenario requires the use of additional SE or repairmen, there is a possibility the MTTR of the end item may not be the same as for other repair actions. Therefore, identify the MTTR of the end item when it fails due to the failure of this LRU.

MTBF MULTIPLIER. This input is used to conduct sensitivity analysis on MTBF. COMPASS will multiply each item's entered MTBF by this factor to increase or decrease the entered MTBFs. For example, to decrease the MTBFs of all items by 40 percent, input a factor 0.6. To increase all MTBFs by 40 percent, input a factor of 1.4. The default value is 1.

MTTR (INCLUDING DIAGNOSTIC TIME). The total elapsed time (clock hours) for corrective maintenance divided by the total number of corrective maintenance actions during a given period of time. The diagnostic time is included in the total Mean Time To Repair (MTTR).

NAME. The alphanumeric identification of the system/end item being analyzed.

NON BIASED STOCKAGE OPTIMIZATION. The SESAME routines that are embedded in COMPASS incorporates some logic that gives bias towards stocking some higher priced, perceived important, LRU's in the field. This was done to satisfy user's (i.e provisioners) of the SESAME model and was thus carried over to the COMPASS evaluator. COMPASS has the option (answer yes to this question) to compute a "more optimal" SESAME stockage list. This was found to be necessary in some cases where the repair policy was influenced by the stockage decisions in the original version (i.e answer no to this question) and therefore at times was not the least cost policy for the availability.

NUMBER OF END ITEM ALTERNATIVES PECULIAR TO THIS LRU. Identify the number of end item repair alternatives requiring additional information when the failure of the end item is caused by failure of this LRU. This question only appears when running COMPASS in the multiple repair run mode. Refer to paragraphs 4.8.9.2 through 4.8.9.5. for information relating to additional repair of the end item.

NUMBER OF LRUs WITHIN THE END ITEM. Identify the number of identical LRUs that make up the end item.

NUMBER OF LRUs THAT NEED TO BE OPERABLE. Identify the number of identical LRUs that have to be operable in order for the end item to be operable.

NUMBER OF PAGES OF TECHNICAL DOCUMENTATION. The number of pages of technical documentation that must be developed to fully describe/illustrate the tasks/procedures required to accomplish repair of this item.

NUMBER OF PARTS NEEDING NSN. Of the total number of parts that have been grouped together to form this item, how many of these parts do not have an existing NSN. This is used in calculating the cataloging costs.

NUMBER OF REPAIR ALTERNATIVES. Identify the number of unique ways you wish to identify for repairing the item. This input is only displayed when running COMPASS in the multiple repair run mode. The maximum is three repair alternatives. COMPASS will prompt you for additional information (repair alternative data screen) based on the number of alternatives you entered.

NUMBER OF SHOPS. This input is the number of maintenance/supply shops at each echelon which supports the end item in the field. COMPASS currently considers the standard Army four-level maintenance concept (ORG, DS Unit, (DSU), General Support Unit (GSU), and depot). COMPASS will also consider repair at the contractor's (CONTR) facility (refer to paragraph 4.1.3). COMPASS considers only one depot level shop; therefore, you can model any number of levels of maintenance from 2 to 4.

ONE TIME DEVELOPMENT COST. The one time cost, in dollars, to develop a particular piece of SE. If the SE has already been developed, the development cost is sunk and this input should be zero.

ONE TIME INSTALLATION COST. A one time cost the contractor may charge to repair the item, independent of the number of repairs of that item. This cost may include such things as setting up the maintenance facility, procuring and installing the SE, etc.

OPERATING LEVELS BY ECHELON. The number of days worth of stock intended to sustain normal operations during the interval between receipt of replenishment shipment and submission of subsequent replenishment requisition. The operating level is input for each maintenance echelon. This input is only displayed when one answers "No" to, "Do you want to Spare to Availability?" on the special analysis data screen (refer to paragraph 4.12).

ORDER/SHIP TIME. The number of days between the initiation of a stock replenishment action and receipt of the material by the requesting activity. NOTE: If the user entered a "0" for the Number of Shops at any level, a "0" must also be entered for the Order/Ship Time from that level to the next higher level. For example, you input "0" for the number of DSU shops; therefore, the Order/Ship Time for DSU-GSU must be input as "0".

PACKAGED SHIPPING WEIGHT. The gross weight of the unit pack expressed in pounds.

PRICE OF PARTS FOR AVERAGE REPAIR. The price of the parts which have been grouped together to form this item. If this item contains only one part, then the price would be the unit price of the item itself.

PROCUREMENT LEAD TIME. The average time interval in days between identification of a demand until the item is introduced into the supply system. This time includes administrative delay time, production time, and shipping time.

PRODUCTIVITY FACTOR. This factor is used to account for nonproductive time and has the effect of increasing manpower requirements for performing maintenance.

RECURRING BIN COST. The recurring administrative cost expressed in whole dollars of maintaining a bin for an item in the retail system for 1 year.

RECURRING CATALOGING COST. Recurring administrative cost expressed in whole dollars of maintaining an item in the wholesale supply system for 1 year.

REPAIR ALTERNATIVE NAME. A hardcoded four-character alphanumeric identification of the repair alternative. This input cannot be modified.

REPAIRMAN NAME. This input identifies the MOS code or name of the repairman required to repair/screen an item.

REP/SE NAME. Use this input to identify all SE/repairmen necessary in order to fault isolate and screen/repair the item. The names input here must be input exactly as you entered them in the SE and repairmen data group screens.

RETAIL STOCKAGE CRITERIA. The number of demands per year that must be experienced by a retail stock point to qualify for stockage of a spare of that part. This number is the basis of Standard Initial Provisioning (SIP) stock.

RUN MODE. COMPASS may be run in three different run modes: normal, screening, or multiple repair. Select the mode that best represents the system you are modeling.

a. Normal. For each item, COMPASS will consider only one methodology of repair and not consider screening to capture falsely removed items.

b. Screening. Allows COMPASS to consider the cost effectiveness of testing an item to see if it was falsely removed (i.e., no evidence of failure) before the item is evacuated all the way back to the prescribed maintenance echelon for repair.

c. Multiple Repair. COMPASS will consider more than one repair method (maximum of three) for any item being analyzed. Under this run mode, COMPASS will identify the most economical level of repair and also identify the most economical method of repair for the item. This is useful in evaluating different pieces of support equipment (i.e., common versus special) or when determining the cost effectiveness of built-in-test-equipment.

SALARY LOADING FACTOR. A factor which is applied to the hourly and annual manpower costs to account for overhead, benefits, permanent change of station moves, hazardous duty, etc.

SCREENING DETECTION FRACTION. The fraction, expressed as a percentage of removals, that are identified during screening to be operational (falsely removed) and, thus, may be put back into the supply system.

SCREENING TIME. The average time, in hours, required to screen an item to determine if it has actually failed, or if it has been falsely removed.

SE LIFE. The estimated useful life, in years, of the SE. When the life of the SE is less than the life of the system being modeled, COMPASS will charge for the procurement of a replacement piece of SE at the end of its life.

SE NAME. The name of the SE.

SPECIAL ORDER AND SHIP TIME. The time, in days, to move a good end item from the issuing echelon to the ORG level. If the issuing echelon is the ORG level, then the value for this input should be 0.

SUPPLY SYSTEM INDICATOR. The supply support methodology used in computation of stockage levels. There are three alternatives: vertical;
nonvertical; and reparable exchange. An explanation of the difference between the three are provided below:

a) Vertical. The GSU shop performs a normal supply mission with the vertical system.

b) Nonvertical. In the nonvertical system, the GSU is only authorized to stock those items removed and replaced at the GSU in quantities necessary to provide shop stock. If an item is repaired by a GSU, it is assumed that the item is being repaired for a DSU on a job order basis, and that it is returned immediately.

c) Reparable Exchange. In the reparable exchange system, the GSU is permitted to stock those items that are repaired at the GSU in addition to necessary shop stock. The additional items are stocked only if the number of issues at the GSU equals or exceeds the stockage criteria.

TEST PROGRAM SET (TPS) DEV COST. The one-time, up-front cost, expressed as dollars, associated with development of the TPS required to repair/screen the item under this repair alternative. This cost should also contain the cost of the interconnect device if it is used solely for this item. If the interconnect device is shared among other items, it should be input as a piece of SE. This TPS cost will only be charged to your system if COMPASS determines it is more economical to repair the item using the TPS than to discard the item and not develop the TPS.

TIME. The time the SE or repairman is used for fault isolation and screening/repair of the item. The default value is the MTTR entered above.

TOTAL MEAN TIME BETWEEN FAILURE. The combined MTBF for all of the parts that make up this item.

TOTAL NUMBER OF PARTS. The total number of parts that have been grouped together to form this item. A bin will be charged for each of these parts wherever this item is stocked. If there is only one item input a "1."

TRANSPORTATION COST ($/lb/mile). The transportation rate, expressed in dollars per pound per mile, for transportation of material between maintenance echelons.

TURN AROUND TIME (Repair). The average elapsed time from the arrival of a failed item at the maintenance echelon where it is to be repaired, until it is repaired and ready for use. This time includes administrative waiting time, processing time, and actual repair time. It does not include shipping time or waiting time for parts/SRUs/LRUs to repair the item. These two areas will be added internally within the model to compute a total turnaround time. The turnaround time entered on the system echelon placement screen will serve as the default turnaround time for the end item and each LRU/SRU that has been added.

TURN AROUND TIME (Screening). The average elapsed time from the arrival of a suspected failed item at the maintenance echelon where it is to be screened, until it is screened and sent for repair or returned to stock and ready for use. This time includes administrative waiting time, processing time, and actual screening time. It does not include shipping time. Shipping time is assumed to be equal to the order ship time and is added internally by COMPASS. These inputs will only be displayed when COMPASS is run in the screening run mode. The turnaround time entered on the system echelon placement screen will serve as the default turnaround time for the end item and each LRU/SRU that has been added.

UNIT PRICE. The price in dollars and cents for one unit of issue of the item.

UNLOADED BASE HOURLY RATE. The average direct labor rate per hour for a repairman at a given maintenance echelon. The labor rate is expressed in units of dollars and cents.

WARFACTOR MULTIPLIER. COMPASS uses this input to account for the increase in the number of failures when the end item is being operated under wartime conditions. This increase in failures may be due to an increase in annual operating hours or increased stress on the equipment. The factor is multiplied by the annual operating hours to account for the increase in failures anticipated during wartime operation. For example, to increase the failure by 50 percent input a factor of 1.5. The default value is 1. This input is generally used in conducting sensitivity analysis.

WASHOUT RATE. The fraction, expressed as a decimal, of failures of a reparable item that cannot be repaired due to physical damage/loss at the contractor's facility.

WEIGHT OF PARTS FOR AVERAGE REPAIR. The total weight of the parts which have been grouped together to form this item. If this item contains only one part, then the weight would be the weight of the item itself.

WHOLESALE FILL RATE. This input is the wholesale stock availability. In most cases, this value should be set to .85, which is the default value. This means that the major support command (MSC) is expected to be able to fill any requisition on the "first pass" at least 85 percent of the time.

WILL CONTRACTOR RECEIVE EQUAL PROPORTION OF FAILURES. Answer yes or no depending on whether the Army must give the contractor the same proportion of repairs for each failure mode of a particular LRU. In most cases, the answer to this question should be yes. An example follows: LRU has SRU 1 which costs $1.00, and SRU 2 which costs $1,000. If the contractor cost to repair is $600 regardless of failure mode, COMPASS would tend to give the contractor the LRU when SRU 2 fails, but not when SRU 1 fails. By answering yes, COMPASS will not be allowed to do this. When this input is "yes" and you consider contractor repair of the LRUs and SRUs, an additional input "Contr Cost" will be displayed on part 2 of the SRU data screen.

WILL FAILURE OF THIS LRU RESULT IN ISSUE OF A FLOAT. This input requires a yes or no answer. Answer yes if you have spare end items that can replace the failed end item when this particular LRU fails. Answer no otherwise. This is only asked if you are considering end item floats.

WITH WHAT REPAIR ALTERNATIVE IS THIS ASSOCIATED. The end item repair alternative name this additional repair information is associated with. The name listed here must correspond to the repair alternative name for the end item.

Appendix B

Sample FEA Print Output

The following pages present an example of a printed FEA output report. The print command is found at <View Results>-><FEA>-><File>-><Print>. The print command is set to print to the default printer and the report is set to print in Landscape mode.

Front End Analysis Report

SYSTEM INFORMATION

Enditem Assembly	NO
Enditem Float	NO
Contractor Repair	YES
Redundancy	NO
Run Mode	SCREENING
Number Shops at Org	30
Number Shops at DSU	10
Number Shops at GSU	0

Repair Placement

Item	ORG	DSU	GSU	Depot	Contractor
End Item Repair	YES	YES	NO	NO	NO
LRU Repair	NO	YES	NO	YES	YES
SRU Repair	NO	YES	NO	YES	YES
Default TAT	2	30	30	120	

Screening Placement

Item	ORG	DSU	GSU	Depot
End Item Screen	NO	NO	NO	NO
LRU Screen	NO	YES	NO	YES
SRU Screen	NO	YES	NO	YES
Default TAT	1	5	10	15

Special Analysis Data

Discount Rate	0.1
Spare to Availability	YES
MTBF Multiplier	1
Warfactor Multiplier	1
Promote SRU's	YES
Equal Contractor Proportion	YES
Wholesale Fill Rate	0.85
Float Computed per Optimization	NO
Input Curve Parameter	0
Curve Parameter Multiplier	1
Non-biased Stockage	YES
Scale Factor	1
Present Value Factor	8.939

Supply

Procurement Lead Time	365
Initial Bin Cost	160
Recurring Bin Cost	50
Calculated Bin Cost	606.96
Holding Cost Factor	0.06
Calculated HCF	0.5
Cost per Requisition	30.42
Initial Cataloging Cost	615
Recurring Cataloging Cost	204.75
Calculated Cataloging Cost	2249.8
Tech Doc Cost Per Page	446.75
Supply System Indicator	VERTICAL

Common Labor

	ORG	DSU	GSU	Depot
Unloaded Hourly Rate	7.25	10.3	21	21
Productivity Factor	0.85	0.85	0.85	0.85
Loading Factor	0.9	0.9	0.45	0.45
Calc Loaded Rate ($/hr)	16.21	23.02	35.82	35.82
Calc Loaded Rate (PVF$/hr)	144.87	205.81	320.24	320.24

Transportation

	ORG-DSU	DSU-GSU	GSU-DEPOT
Order Ship Time(days)	2	30	0
Cost ($/lb-mi)	0	0	0
Distance Between Echelons (Mi)	0	0	0
Cost ($/lb)	0.06	0.06	0.06
Calculated Cost ($/lb)	0.0600	0.0600	0.0000
Calculated Cost (PVF$/lb)	0.5363	0.5363	0.0000

Support Equipment - General Information

SE Name	SE Life	Development Cost	Repair Only?	Authorized	Common
IFTE	20	0	NO	DSU	DSU

Support Equipment - Level Specific Information

IFTE	ORG	DSU	GSU	Depot
Unit Price	0	2500000	0	2500000
Install Cost	0	0	0	100000
Annual Maint Cost	0	150000	0	150000
Available Hours (yr)	0	1500	0	2087
Calc. Equip Cost (PVF)	0.00	3840886.27	0.00	3940886.27

Repairmen - General Information

Name	Repair Only?	Authorized	Common
24N	NO	ORG	ORG
27T	YES	DSU	NOT COMMON
27Y	NO	DSU	DSU

DEPREP	NO	DEP	DEP

Repairmen - Level Specific Information

24N	ORG	DSU	GSU	Depot
Annual Salary	10524	10524	10524	20000
Training cost	1500	1500	1500	1500
Salary Load Factor	0.9	0.9	0.9	0.45
Turn Over Rate	0.4	0.4	0.4	0.2
Available Hours	1500	1500	1500	2087
Repairmen Cost (PVF)	184109.05	184109.05	184109.05	261919.78

27T	ORG	DSU	GSU	Depot
Annual Salary	10524	10524	10524	20000
Training cost	30000	30000	30000	30000
Salary Load Factor	0.9	0.9	0.9	0.45
Turn Over Rate	0.4	0.4	0.4	0.2
Available Hours	1500	1500	1500	2087
Repairmen Cost (PVF)	0.00	286016.40	286016.40	312873.46

27Y	ORG	DSU	GSU	Depot
Annual Salary	10524	10524	10524	20000
Training cost	5000	5000	5000	5000
Salary Load Factor	0.9	0.9	0.9	0.45
Turn Over Rate	0.4	0.4	0.4	0.2
Available Hours	1500	1500	1500	2087
Repairmen Cost (PVF)	0.00	196623.99	196623.99	268177.25

DEPREP	ORG	DSU	GSU	Depot
Annual Salary	0	0	0	35000
Training cost	0	0	0	1500
Salary Load Factor	0	0	0	0.45
Turn Over Rate	0	0	0	0.2
Available Hours	0	0	0	2087
Repairmen Cost (PVF)	0.00	0.00	0.00	456348.29

End Item Data

Name	M65-TOW
Life	20
Density	690
Unit Price	1000000
Unit Price (PVF)	8939241.82
Weight	990
Annual Operating Hours	550
Ao Target	0.9
Calculated Ai	0.9990
MTBF	300
Derived MTBF	304.46
Failures (density/yr)	1.8065
DS Delay Cost	0
DS Delay Time	0

End Item - Repair Data

Name	Rep Alt #	MTTR	Diag Time	TPS Dev	TPS Maint	Pages Tech Docs
M65-TOW	alt1	5	0	0	0	50

End Item - Repairmen and Support Equipment

M65-TOW	Rep Alt #	REP/SE Name	Time
	alt1	24N	5

LRU Data

Name	Unit Price	ESS	Weight	FRR	NSN	Wash Out	TAT-ORG	TAT-DSU	TAT-GSU	TAT-DEP
SHC	2773	1	14	0.05	NO	0.02	2	30	60	120

PSI	4000	1	240	0.2	NO	0.02	2	30	60	120
TCP	25298	1	17	0.05	NO	0.02	2	30	60	120
TSU	314863	1	414	0.2	NO	0.02	2	30	60	120
TML	31000	1	156	0.05	NO	0.02	2	30	60	120
SCA	110628	1	58	0.01	NO	0.02	2	30	60	120
MCA	24428	1	42	0.05	NO	0.02	2	30	60	120
EPS	45551	1	49	0.05	NO	0.02	2	30	60	120

LRU - Optional Data

Name	# Rep Alts	Contr	Float	Screen	Add Repair	# Add Rep	Redundant	# Redundant	# Operational
SHC	1	NO	NO	NO	NO	0	NO	0	0
PSI	1	NO	NO	YES	NO	0	NO	0	0
TCP	1	NO	NO	NO	NO	0	NO	0	0
TSU	1	NO	NO	YES	NO	0	NO	0	0
TML	1	NO	NO	NO	NO	0	NO	0	0
SCA	1	NO	NO	NO	NO	0	NO	0	0
MCA	1	NO	NO	NO	NO	0	NO	0	0
EPS	1	NO	NO	NO	NO	0	NO	0	0

LRU - Repair Data

Name	Rep Alt #	MTTR	Diag Time	TPS Dev	TPS Maint	Pages Tech Docs
SHC	alt1	3	2	0	0	20
PSI	alt1	2.75	0.25	200000	50000	15
TCP	alt1	2.8	1.8	0	0	15
TSU	alt1	2.5	0.25	200000	50000	35
TML	alt1	3.2	0.5	0	0	20
SCA	alt1	3.5	1	200000	50000	30
MCA	alt1	2.5	0.25	0	0	20
EPS	alt1	4.4	1.5	0	0	10

LRU - Repairmen and Support Equipment

SHC	Rep Alt #	REP/SE Name	Time

alt1	27T	1
alt1	IFTE	3
alt1	27Y	2

PSI	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	2.75
	alt1	27T	2.5
	alt1	27Y	0.25

TCP	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	2.8
	alt1	27T	1
	alt1	27Y	1.8

TSU	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	2.5
	alt1	27T	2.25
	alt1	27Y	0.25

TML	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	2.2
	alt1	27T	1.7
	alt1	27Y	0.5

SCA	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	3.5
	alt1	27T	2.5
	alt1	27Y	1

MCA	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	2.5
	alt1	27T	2.25

	alt1	27Y	0.25
EPS	**Rep Alt #**	**REP/SE Name**	**Time**
	alt1	IFTE	4.4
	alt1	27T	2.9
	alt1	27Y	1.5

LRU - Screening Data

Name	Screen Time	SDF	TPS DEV Cost	TPS Maint	TAT-ORG	TAT-DSU	TAT-GSU	TAT-DEP
PSI	1	0.9	100000	25000	0	5	10	15
TSU	1	0.9	100000	25000	0	5	10	15

LRU - Screening Repairmen and Support Equipment

PSI	REP/SE Name	Time
	IFTE	1
	27T	1

TSU	REP/SE Name	Time
	IFTE	1
	27T	1

SRU Data

Name	Unit Price	ESS	Weight	FRR	NSN	Wash Out	TAT-ORG	TAT-DSU	TAT-GSU	TAT-DEP
TRACKCON	2200	1	10	0.05	YES	0.05	2	30	60	120

POTENT	500	1	4	0.1	YES	0.05	2	30	60	120
DSPL CRT	3800	1	6	0.05	YES	0.05	2	30	60	120
CNTRL IND	15000	1	5	0.05	YES	0.05	2	30	60	120
STATUS IND	11000	1	5	0.05	YES	0.05	2	30	60	120
IR TRACKER	50000	1	75	0.05	YES	0.05	2	30	60	120
ERR DET	50000	1	75	0.05	YES	0.05	2	30	60	120
OPT FIELD	200000	1	300	0.2	NO	0.05	2	30	60	120
STACKER	25000	1	50	0.05	YES	0.05	2	30	60	120
STAB CCA	90000	1	28	0.25	YES	0.05	2	30	60	120
AMP CCA	20000	1	30	0.05	YES	0.05	2	30	60	120
MISSLE CMD	5000	1	12	0.05	YES	0.05	2	30	60	120
DC CONVERT	22500	1	24	0.05	YES	0.05	2	30	60	120
AC CONVERT	22500	1	24	0.05	YES	0.05	2	30	60	120

SRU - Optional Data

Name	# Rep Alts	Contr	Screen	# NSN	Parts Cost	Add Rep	# Add Rep	Contr LRU Rep($)
TRACKCON	1	NO	NO	0	220	NO	0	0
POTENT	1	NO	NO	0	50	NO	0	0
DSPL CRT	1	NO	NO	0	380	NO	0	0
CNTRL IND	1	YES	NO	0	1500	NO	0	0
STATUS IND	1	YES	NO	0	1100	NO	0	0
IR TRACKER	1	NO	NO	0	5000	NO	0	0
ERR DET	1	NO	NO	0	5000	NO	0	0
OPT FIELD	1	NO	YES	0	20000	NO	0	0
STACKER	1	NO	NO	0	2500	NO	0	0
STAB CCA	1	NO	YES	0	9000	NO	0	0
AMP CCA	1	YES	NO	0	2000	NO	0	0
AMP CCA	1	YES	NO	0	2000	NO	0	0
MISSLE CMD	1	NO	NO	0	500	NO	0	0
DC CONVERT	1	NO	NO	0	2250	NO	0	0
AC CONVERT	1	NO	NO	0	2250	NO	0	0

SRU - Repair Data

Name	Rep Alt #	MTTR	Diag Time	TPS Dev	TPS Maint	Pages Tech Docs

TRACKCON	alt1	2.5	0.5	0	0	10
POTENT	alt1	2	0.5	0	0	10
DSPL CRT	alt1	1.5	1	0	0	5
CNTRL IND	alt1	1.5	1	0	0	5
STATUS IND	alt1	2.5	1.5	0	0	5
IR TRACKER	alt1	3.5	1.5	0	0	15
ERR DET	alt1	3	1	0	0	20
OPT FIELD	alt1	5	2	100000	25000	30
STACKER	alt1	1.5	0.5	0	0	10
STAB CCA	alt1	3	1	100000	25000	5
AMP CCA	alt1	3	1	0	0	5
MISSLE CMD	alt1	2	0.5	0	0	5
DC CONVERT	alt1	1.5	0.5	0	0	5
AC CONVERT	alt1	1.5	0.5	0	0	5

SRU Repairmen and Support Equipment

TRACKCON	Rep Alt #	REP/SE Name	Time
	alt1	27T	2
	alt1	27Y	0.5
	alt1	IFTE	2.5

POTENT	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	2
	alt1	27T	1.5
	alt1	27Y	0.5

DSPL CRT	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	2
	alt1	DEPREP	2

CNTRL IND	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	1.5
	alt1	27T	0.5

	alt1	27Y	1

STATUS IND	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	2.5
	alt1	27T	1
	alt1	27Y	1.5

IR TRACKER	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	3.5
	alt1	DEPREP	3.5

ERR DET	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	3
	alt1	DEPREP	3

OPT FIELD	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	5
	alt1	DEPREP	5

STACKER	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	1.5
	alt1	27T	1
	alt1	27Y	0.5

STAB CCA	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	3
	alt1	DEPREP	3

AMP CCA	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	3
	alt1	DEPREP	3

MISSLE CMD	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	2
	alt1	27T	1.5
	alt1	27Y	0.5

DC CONVERT	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	1.5
	alt1	DEPREP	1.5

AC CONVERT	Rep Alt #	REP/SE Name	Time
	alt1	IFTE	1.5
	alt1	DEPREP	1.5

SRU - Contractor Repair Data

Name	Wash Out	TAT	Initial Cost	Cost/Failure	Diagnostic Cost	Ship To	Receive From
CNTRL IND	0.05	90	200000	3000	3000	DEP	DEP
STATUS IND	0.05	90	200000	2200	2200	DEP	DEP
AMP CCA	0.05	90	200000	4000	4000	DEP	DEP

SRU MTBF

SRU Name	LRU Name	MTBF
TRACKCON	SHC	10000
POTENT	SHC	14285
DSPL CRT	PSI	16667
CNTRL IND	TCP	3333
STATUS IND	TCP	9090
IR TRACKER	TSU	6000
ERR DET	TSU	4500
OPT FIELD	TSU	6000

Appendix C

Optimizer/Evaluator Sample Print Output

The following pages present an example of a printed Optimizer/Evaluator output report. The print command is found at <View Results>-><Optimizer>-><File>-><Print>. To print the Evaluator report substitute <Evaluator> in the above statement. The print command is set to print to the default printer and the report is set to print in Landscape mode.

C:\Compass 3.0\output.mdb
6/24/2001
COMPASS 3.0 Feb 2001

COMPASS Policy Optimization Report

Maintenance Policies by Application

LRU	SRU	Repair Level EI	LRU	SRU	Time	SRU Promoted	Sensitivity
SHC	TRACKCON	DSU	DSU	DSU	1.000		
SHC	POTENT	DSU	DSU	TOSS	1.000		
PSI	DSPL CRT	DSU	DSU	DEP	1.000		
TCP	CNTRL IND	DSU	DSU	DSU	1.000		
TCP	STATUS IND	DSU	DSU	DSU	1.000		
TSU	IR TRACKER	DSU	DSU	DEP	1.000		
TSU	ERR DET	DSU	DSU	DEP	1.000		
TSU	OPT FIELD	DSU	DSU	DEP	1.000		
TML	STACKER	DSU	DSU	DSU	1.000		
TML	L-TUBES	DSU	DSU	TOSS	1.000		
SCA	STAB CCA	DSU	DSU	DEP	1.000		
SCA	AMP CCA	DSU	DSU	DEP	1.000		
MCA	AMP CCA	DSU	DSU	DEP	1.000		
MCA	MISSLE CMD	DSU	DSU	DSU	1.000		
EPS	DC CONVERT	DSU	DSU	DEP	1.000		
EPS	AC CONVERT	DSU	DSU	DEP	1.000		

Screening Policies by Application

Item Type	Item Name	Screen Level	Repair Level	Time	Sensitivity	Labor	Savings	TPS Scrn Only?
SRU	OPT FIELD	DSU	DEP	1.000		Null	Null	Null
SRU	STAB CCA	DSU	DEP	1.000		Null	Null	Null

Support Equipment/Repairmen Requirements

Non-Common Repairmen

Org Shops = 30 DSU Shops = 10 GSU Shops = 0 Depot = 1

Name	Echelon	Shop Requirement	Shop Quantity	Echelon Total	Total Cost	Accumulating Quantity
27T	DSU	0.212	1	10	2860164.	10

Common Repairmen

Org Shops = 30 DSU Shops = 10 GSU Shops = 0 Depot = 1

Name	Echelon	Shop Requirement	Shop Quantity	Echelon Total	Total Cost	Accumulating Quantity
24N	DSU	0.415	.415	4.15	764965.	4.15
27Y	DSU	0.111	.111	1.11	218008.	1.11
DEPREP	DEP	0.872	.872	0.87	397789.	0.87

Common Support Equipment

Org Shops = 30 DSU Shops = 10 GSU Shops = 0 Depot = 1

Name	Echelon	Shop Requirement	Shop Quantity	Echelon Total	Total Cost	Development Cost Cost	Accumulating Quantity
IFTE	DSU	0.323	0.323	3.23	12420077.	0.	3.23
IFTE	DEP	0.872	0.872	0.87	3435185.	0.	4.11

Logistics Costs (Present Value $)

LRU Costs

Name	Initial Spares	Consump Spares	Common Labor	Contr Vcost	TPS Cost	Holding Cost
SHC	91,509.	33,585.	0.	0.	0.	49,081.
PSI	84,000.	19,540.	0.	0.	646,962.	45,054.

SCA	331,884.	1,963,548.	0.	0.	646,962.	178,007.
MCA	586,272.	522,084.	0.	0.	0.	314,449.
EPS	2,368,653.	3,666,791.	0.	0.	0.	1,270,436.

LRU Costs (Cont)

Name	Transportation	Recquisition	Bin Cost	Cataloging	Tech Docs	Fixed Contr	Contact Team
SHC	10.	368.	6,677.	2,250.	8,935.	0.	0.
PSI	70.	149.	6,677.	2,250.	6,701.	0.	0.
TCP	30.	889.	6,677.	2,250.	6,701.	0.	0.
TSU	1,124.	1,376.	607.	2,250.	15,636.	0.	0.
TML	267.	867.	6,677.	2,250.	8,935.	0.	0.
SCA	62.	540.	607.	2,250.	13,403.	0.	0.
MCA	54.	650.	6,677.	2,250.	8,935.	0.	0.
EPS	237.	2,449.	6,677.	2,250.	4,468.	0.	0.

SRU Costs

Name	Initial Spares	Consump Spares	Common Labor	Contr Vcost	TPS Cost	Parts Cost	Holding Cost
TRACKCON	6,600.	38,399.	0.	0.	0.	107,637.	3,540.
POTENT	22,000.	128,003.	0.	0.	0.	0.	11,800.
DSPL CRT	53,200.	39,795.	0.	0.	0.	92,564.	28,534.
CNTRL IND	270,000.	785,514.	0.	0.	0.	1,879,710.	144,816.
STATUS IND	154,000.	211,216.	0.	0.	0.	532,314.	82,599.
IR TRACKER	1,750,001.	1,454,511.	0.	0.	0.	3,317,264.	938,620.
ERR DET	2,250,001.	1,939,348.	0.	0.	0.	4,407,453.	1,206,797.
OPT FIELD	6,800,003.	6,649,192.	0.	0.	323,481.	15,122,961.	3,647,208.
STACKER	150,000.	872,706.	0.	0.	0.	2,080,606.	80,453.
STAB CCA	2,970,001.	2,973,581.	0.	0.	323,481.	6,770,412.	1,592,972.
AMP CCA	1,020,000.	698,165.	0.	0.	0.	1,588,301.	547,081.
MISSLE CMD	130,000.	174,541.	0.	0.	0.	437,603.	69,726.
DC CONVERT	2,880,001.	2,218,745.	0.	0.	0.	5,004,372.	1,544,700.
AC CONVERT	2,880,001.	2,218,745.	0.	0.	0.	5,004,372.	1,544,700.
L-TUBES	267,500.	1,745,412.	0.	0.	0.	0.	143,475.

SRU Costs (Cont)

Name	Transportation	Recquisition	Bin Cost	Cataloging	Tech Docs	Fixed Contr	Contact Team
TRACKCON	10.	531.	607.	0.	4,468.	0.	0.

POTENT	61.	7,788.	6,677.	0.	0.	0.	0.
DSPL CRT	147.	6,371.	607.	0.	2,234.	0.	0.
CNTRL IND	16.	1,593.	6,677.	0.	2,234.	0.	0.
STATUS IND	6.	584.	6,677.	0.	2,234.	0.	0.
IR TRACKER	5,105.	17,698.	607.	0.	6,701.	0.	0.
ERR DET	6,807.	23,598.	607.	0.	8,935.	0.	0.
OPT FIELD	19,928.	17,345.	607.	2,250.	13,403.	0.	0.
STACKER	105.	1,062.	607.	0.	4,468.	0.	0.
STAB CCA	1,785.	16,664.	607.	0.	2,234.	0.	0.
AMP CCA	2,451.	21,238.	6,677.	0.	2,234.	0.	0.
MISSLE CMD	25.	1,062.	6,677.	0.	2,234.	0.	0.
DC CONVERT	5,538.	32,632.	6,677.	0.	2,234.	0.	0.
AC CONVERT	5,538.	32,632.	6,677.	0.	2,234.	0.	0.
L-TUBES	4,273.	21,238.	6,677.	2,250.	0.	0.	0.

Parts Costs

Used on SRU	Initial Parts	Consump. Parts	Holding	Requisition	Bin Cost	Cataloging
TRACKCON	11,660.	72,958.	6,254.	10,088.	6,677.	0.
DSPL CRT	10,640.	75,610.	5,707.	0.	607.	0.
CNTRL IND	228,000.	1,492,480.	122,289.	30,267.	6,677.	0.
STATUS IND	73,700.	401,310.	39,529.	11,098.	6,677.	0.
IR TRACKER	360,000.	2,763,570.	193,087.	0.	607.	0.
ERR DET	470,000.	3,684,760.	252,086.	0.	607.	0.
OPT FIELD	1,620,000.	12,633,500.	868,894.	0.	607.	0.
STACKER	257,500.	1,658,140.	138,111.	20,176.	6,677.	0.
STAB CCA	729,000.	5,649,800.	391,002.	0.	607.	0.
AMP CCA	170,000.	1,326,510.	91,180.	0.	607.	0.
MISSLE CMD	51,500.	331,628.	27,622.	20,176.	6,677.	0.
DC CONVERT	513,000.	4,215,610.	275,150.	0.	607.	0.
AC CONVERT	513,000.	4,215,610.	275,150.	0.	607.	0.

RTD's, MTD's & TAT's

LRU Distributions

Name	RTD ORG	RTD DSU	RTD GSU	RTD DEP	MTD ORG	MTD DSU	MTD GSU	MTD DEP	Wash Out
SHC	0.000	1.000	0.000	0.000	0.000	0.980	0.000	0.000	0.020

PSI	0.000	1.000	0.000	0.000	0.000	0.980	0.000	0.000	0.020
TCP	0.000	1.000	0.000	0.000	0.000	0.980	0.000	0.000	0.020
TSU	0.000	1.000	0.000	0.000	0.000	0.980	0.000	0.000	0.020
TML	0.000	1.000	0.000	0.000	0.000	0.980	0.000	0.000	0.020
SCA	0.000	1.000	0.000	0.000	0.000	0.980	0.000	0.000	0.020
MCA	0.000	1.000	0.000	0.000	0.000	0.980	0.000	0.000	0.020
EPS	0.000	1.000	0.000	0.000	0.000	0.980	0.000	0.000	0.020

LRU TAT's

	TAT				Sesame TAT			
Name	ORG	DSU	GSU	DEP	ORG	DSU	GSU	DEP
SHC	2.0	54.7	60.0	120.0	2.0	54.7	60.0	120.0
PSI	2.0	64.4	60.0	120.0	2.0	64.4	60.0	120.0
TCP	2.0	40.1	60.0	120.0	2.0	40.1	60.0	120.0
TSU	2.0	61.3	60.0	120.0	2.0	61.3	60.0	120.0
TML	2.0	47.7	60.0	120.0	2.0	47.7	60.0	120.0
SCA	2.0	50.8	60.0	120.0	2.0	50.8	60.0	120.0
MCA	2.0	34.4	60.0	120.0	2.0	34.4	60.0	120.0
EPS	2.0	38.1	60.0	120.0	2.0	38.1	60.0	120.0

SRU Distributions

	RTD				MTD				
Name	ORG	DSU	GSU	DEP	ORG	DSU	GSU	DEP	Wash Out
TRACKCON	0.000	1.000	0.000	0.000	0.000	0.950	0.000	0.000	0.050
POTENT	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000
DSPL CRT	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.950	0.050
CNTRL IND	0.000	1.000	0.000	0.000	0.000	0.950	0.000	0.000	0.050
STATUS IND	0.000	1.000	0.000	0.000	0.000	0.950	0.000	0.000	0.050
IR TRACKER	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.950	0.050
ERR DET	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.950	0.050
OPT FIELD	0.000	1.000	0.000	0.000	0.000	0.142	0.000	0.808	0.050
STACKER	0.000	1.000	0.000	0.000	0.000	0.950	0.000	0.000	0.050

STAB CCA	0.000	1.000	0.000	0.000	0.000	0.171	0.000	0.779	0.050
AMP CCA	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.950	0.050
MISSLE CMD	0.000	1.000	0.000	0.000	0.000	0.950	0.000	0.000	0.050
DC CONVERT	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.950	0.050
AC CONVERT	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.950	0.050
L-TUBES	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000

SRU TAT's

	TAT				Sesame TAT			
Name	ORG	DSU	GSU	DEP	ORG	DSU	GSU	DEP
TRACKCON	2.0	36.6	60.0	120.0	2.0	36.6	60.0	120.0
POTENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DSPL CRT	2.0	30.0	60.0	124.7	2.0	30.0	60.0	154.7
CNTRL IND	2.0	31.0	60.0	120.0	2.0	31.0	60.0	120.0
STATUS IND	2.0	31.1	60.0	120.0	2.0	31.1	60.0	120.0
IR TRACKER	2.0	30.0	60.0	122.3	2.0	30.0	60.0	152.3
ERR DET	2.0	30.0	60.0	122.1	2.0	30.0	60.0	152.1
OPT FIELD	2.0	5.0	60.0	122.4	2.0	5.0	60.0	152.4
STACKER	2.0	32.3	60.0	120.0	2.0	32.3	60.0	120.0
STAB CCA	2.0	5.0	60.0	122.2	2.0	5.0	60.0	152.2
AMP CCA	2.0	30.0	60.0	122.3	2.0	30.0	60.0	152.3
MISSLE CMD	2.0	32.3	60.0	120.0	2.0	32.3	60.0	120.0
DC CONVERT	2.0	30.0	60.0	121.3	2.0	30.0	60.0	151.3
AC CONVERT	2.0	30.0	60.0	121.3	2.0	30.0	60.0	151.3
L-TUBES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

LRU Spares

Org Shops = 30 DSU Shops = 10 GSU Shops = 0 Depot = 1

	Spares per Shop						
Name	ORG	DSU	GSU	DEP	QTY * UP	Failures/El/Yr	LRUMTBF
SHC	0.	3.	0.	3.	91,509.	0.098	5612.24

PSI	0.	2.	0.	1.	84,000.	0.040	13750
TCP	0.	2.	0.	5.	632,450.	0.237	2320.67
TSU	0.	0.	0.	7.	2,204,042.	0.367	1498.63
TML	0.	2.	0.	5.	775,000.	0.231	2380.95
SCA	0.	0.	0.	3.	331,884.	0.144	3819.44
MCA	0.	2.	0.	4.	586,272.	0.173	3179.19
EPS	0.	4.	0.	12.	2,368,653.	0.653	842.26

SRU Spares

Org Shops = 30   DSU Shops = 10   GSU Shops = 0   Depot = 1

	Spares per Shop					
Name	ORG	DSU	GSU	DEP	QTY * UP	Failures/EI/Yr
TRACKCON	0.	0.	0.	3.	6,600.	0.057
POTENT	0.	1.	0.	34.	22,000.	0.042
DSPL CRT	0.	0.	0.	14.	53,200.	0.034
CNTRL IND	0.	1.	0.	8.	270,000.	0.170
STATUS IND	0.	1.	0.	4.	154,000.	0.062
IR TRACKER	0.	0.	0.	35.	1,750,001.	0.094
ERR DET	0.	0.	0.	45.	2,250,001.	0.126
OPT FIELD	0.	0.	0.	34.	6,800,003.	0.108
STACKER	0.	0.	0.	6.	150,000.	0.113
STAB CCA	0.	0.	0.	33.	2,970,001.	0.107
AMP CCA	0.	1.	0.	41.	1,020,000.	0.113
MISSLE CMD	0.	2.	0.	6.	130,000.	0.113
DC CONVERT	0.	2.	0.	108.	2,880,001.	0.320
AC CONVERT	0.	2.	0.	108.	2,880,001.	0.320
L-TUBES	0.	2.	0.	87.	267,500.	0.113

Support Equipment/Repairmen Totals (Present Value)

Non - Common Support Equipment	0
Common Support Equipment	15855262
Total Support Equipment	15855262

Non-Common Repairmen	2860164
Common Repairmen	1380762
Total Repairmen	4240926

Logistics Totals (Present Value)

Initial Spares	33,685,116.
Consumption Spares	82,739,336.
Holding	18,067,148.
Transportation	53,648.
Requisition	301,129.
Cataloging	22,499.
Bin	137,173.
Common Labor	0.
Screening	0.
Technical Documentation	129,558.
TPS	2,587,848.
Contact Team	0.
Contract Repair Cost	0.
Contractor Fixed Cost	0.
Total Logistics Cost	137,723,456.

Total Cost for Maintenance Policy

Total Logistics Cost	137,723,456.
Total Support Equipment	15855262
Total Repairmen	4240926
Total Maintenance Policy Cost	157,819,648.

Operational Availability	0.9000
Curve Parameter Used	124093.8

Appendix D

Default Values

The default values are based (except where indicated) on the original COMPASS default values that were generated from a survey of the Army's Major Subordinate Commands and Special Repair Activities. The survey was taken during the 1991-1992 timeframe. These costs have been adjusted for inflation using inflation factors developed at Oregon State University. We used an inflation calculator based upon these conversion factors. The conversion factors are found at http://www.orst.edu/dept/pol_sci/fac/sahr/sahr.htm and the inflation calculator is found at http://www.westegg.com/inflation. These values were last updated in March 2000.

Supply Costs

INITIAL BIN COST	$290.62
RECURRING BIN COST	$46.60
HOLDING COST FRACTION (based on a regulation)	0.06
COST PER RECQUISITION	$24.78
INITIAL CATALOGING COST	$998.66
RECURRING CATALOGING COST	$422.56
TECH DOC($/pg) (based on paper TMs)	$566.38

Common Labor Costs

Unloaded Hourly Rate - ORG	$10.32
Unloaded Hourly Rate - DSU	$14.68
Unloaded Hourly Rate - GSU	$29.93
Unloaded Hourly Rate - DEP	$29.93
Productivity Factor - ORG	0.85
Productivity Factor - DSU	0.85
Productivity Factor - GSU	0.85
Productivity Factor - DEP	0.85
Loading Factor - ORG	0.9
Loading Factor - DSU	0.9
Loading Factor - GSU	0.45
Loading Factor - DEP	0.45

Transportation

$/Lb/Mile (ORG-DSU) (From the JAM LORA Defaults)	0.0005
$/Lb/Mile (DSU-GSU) (From the JAM LORA Defaults)	0.0005
$/Lb/Mile (GSU-DEP) (From the JAM LORA Defaults)	0.0005

End Item

Life (Years)	20
Annual Operating Hours	2800

Special Data

Discount Rate (from CEAC based on 20Yr Life)	4.00%
Wholesale Fill Rate (based on a regulation)	0.85

Appendix E

Relevant Documents and additional LOGSA Software

Documents

a) MIL-PRF-49506, Logistics Management Information. This performance specification replaced MIL-STD-1388-2B Logistics Support Analysis Record, and provides guidance on Logistics data products.

b) MIL-HNBK-502, Acquisition Logistics Handbook. This handbook replaced MIL-STD-1388-1A (Logistics Support Analysis). The handbook provides guidance on performing Supportability Analysis throughout the life cycle. The Repair Analysis report summarizes the conclusions and recommendations of the LORA. It also states that the government may verify the conclusions and recommendations by using contractor's input to perform an in-house LORA.

c) AR 700-127, Integrated Logistic Support (ILS). This document states that LORA should be conducted in order to optimize the support system to achieve a minimum life cycle cost and implement a design for discard philosophy.

d) AR 750-1, Army Materiel Maintenance Policies. This document states policies and assigns responsibilities for the maintenance of Army materiel.

LOGSA Software

PowerLog – Logistics Data warehousing tool. Powerlog is based on the old Mil Std 1388-2B which is after MIL-PRF-49506 LMI compliant. PowerLog can be used to store COMPASS outputs or as a source of data. Additional information can be found at www.logsa.army.mil/alc/powerlog, email: powerlog.help@logsa.army.mil, or by calling (256) 955-0807.

CASA – Cost Analysis Strategy Assessment. This is a total ownership cost life cycle analysis model. CASA is normally used after the maintenance concept has been established using COMPASS. Additional information can be found at www.logsa.army.mil/alc/casa, e-mail: mailto:nicholas.giordano@logsa.army.mil, or by calling (256) 955-9782.

PFSA – Post Fielding Support Analysis. This tool is designed to let managers view fielded system information from the various government databases and then use the information to perform analysis such as a LORA. The current version has COMPASS LITE embedded in it. Additional information can be found at www.logsa.army.mil/alc/pfsa, e-mail: mailto:malinda.schmidt@logsa.army.mil, or by calling (256) 955-9910.

COMPASS LITE. This program is used to perform a LORA on a single item. COMPASS LITE computes the repair cost of an item at a maintenance echelon, contractor facility, and performs repair versus discard analysis. Additional information can be found at www.logsa.army.mil/alc/clite, e-mail: shawn.howard@logsa.army.mil, or call (256) 955-8370.